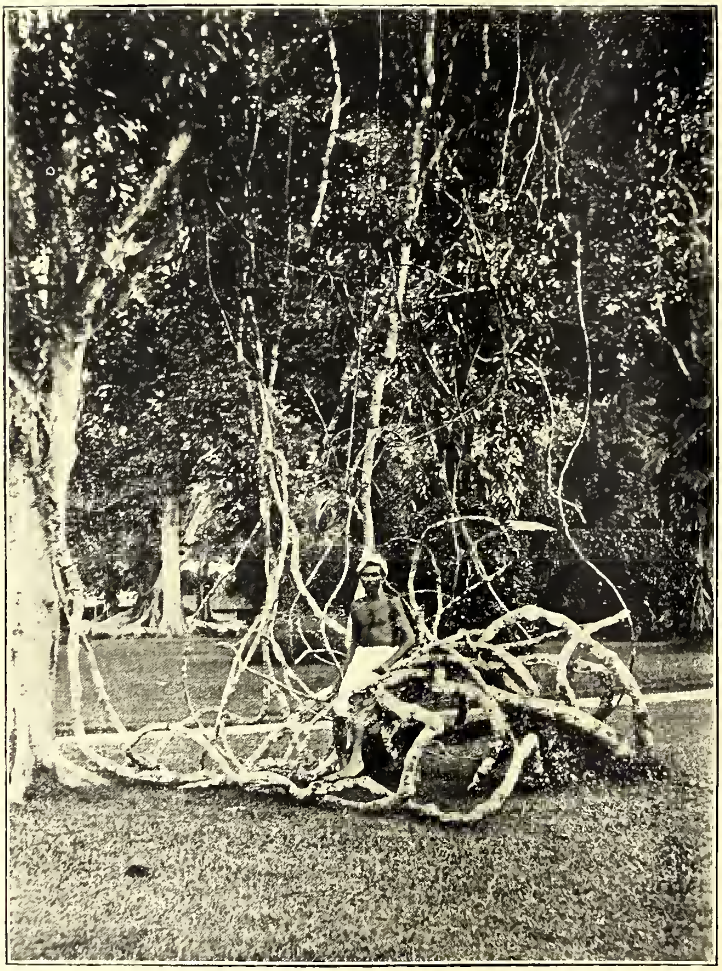

Photo by H. F. Macmillan.

SALACIA RETICULATA.

"Himbutu-wel."

A CURIOUS CEYLON CLIMBER.

THE

TROPICAL AGRICULTURIST

AND

MAGAZINE OF THE

CEYLON AGRICULTURAL SOCIETY.

Vol. XXXIII. COLOMBO, DECEMBER 15th, 1909. No. 6.

Review.

INDIAN INSECT LIFE.

By H. Maxwell Lefroy, M.A., F.E.S., F.Z.S.,
Entomologist, Imperial Department of Agriculture for India.
Calcutta : Thacker Spink & Co.
Price Rs. 20.

Following shortly upon the publication of his useful book on "Indian Insect Pests," Mr. Lefroy has brought out a bulky volume of nearly 800 pages, dealing with Insect Life in India. It is a weighty volume—literally as well as metaphorically—for, owing to the loaded paper upon which it is printed, it scales approximately eight pounds avoirdupois.

To say that "it fills a gap" is to use a very trite expression, but one that is strictly true: for the want of such a work has been felt by every visitor to the East as soon as he begins to pay attention to the innumerable interesting insects that are such a feature of tropical life. We have many (though far from enough) monographs upon particular families or groups of insects; but these are "dry as dust" to all but the specialist, and most of them provide merely technical descriptions of the species without any account of the more interesting and equally important biological side of the question. I have no wish to decry such technical work. It is of the utmost importance, and opens the way to the more popular treatment of the subject. The popular work—in its turn—leads on the enquirer to the study and appreciation of the more technical works. Many a time have I been asked to recommend some book that would give a general account of the insect fauna of the country—in a manner comprehensible to the uinitiated. I have hitherto been compelled to reply that no such book existed. This reproach has now been removed and, for the comparatively modest price of twenty rupees, the enquirer may possess himself of a single volume that will provide just the information that he requires. Not that Mr. Lefroy's book is solely of a popular character. It combines, in a happy manner, general popular and useful information on insect life in India, with a foundation of more technical matter that will put the reader on the right road to the more serious study of the subject—should his interest carry him in that direction. In each section there are simple keys that should enable the veriest tyro to place any insect in its approximate position in the scheme of classification. Many of the more common species are described, and their recognition is further assisted by numerous

coloured plates and text figures. Wherever possible, particulars of life-histories and habits are given; and where no such information is available, the fact is not slurred over, but attention is pointedly drawn to the gaps in our knowledge. This, in itself, is a valuable feature of the book, calculated—as it is—to inspire the student to attack some of the many problems that still await solution. One of the charms of entomological work in the tropics is the knowledge that there are endless new species to be discovered and new facts to be garnered about the species that are already known.

After a useful general introduction, the different orders of insects are discussed in detail according to a scheme of classification that is fully set out at the commencement of the work, starting from the lowest (wingless) insects.

In reviewing a book of this kind, which depends upon hard facts, discussion of individual statements must almost necessarily be of the nature of criticism. After having drawn attention to the merits of the work, what appear to be small errors may be pointed out without detracting from the favourable opinion of the whole. Under Phasmidæ (p. 72), the author is not quite correct in his statement that the "eggs are laid singly, dropped like seeds on the ground." This is certainly true of the Leaf Insects and of some Stick Insects. But other Stick Insects attach their eggs, either singly or in small groups, to the leaves and stems of the plants upon which they feed. The section on Termites is disappointing. There is no proper description of the queen, nor of the economy of the nests. Reference is made to the sponge-like fungus beds; but their arrangement and disposition in the termitarium is not explained. Altogether the pages devoted to this interesting and extremely important family of insects are rather weak and poorly arranged.

Under *Hymenoptera*, a most interesting account of the tactics of *Salius* in the capture of its prey is given on page 216. Such original observations afford an example of what may be done by any patient observer in India. On page 227 is a note on the supposed "mimicry of a species of *Polyrachis* by the nymph of a Coreid bug *Dulichius inflatus.*" The apterous adult of *Dulichius* is almost exactly like the ant in question; but it does not appear to be a specially myrmecophilous species. It is abundant, in Ceylon, amongst grass, quite dissociated from its supposed model. On page 231 is a remarkably good reproduction of the webbing of the large red ant *Œcophylla smaragdina*, and an account of the extraordinary manner in which it is produced. It is also noted that the nests of *Polyrachis* are constructed in the same manner as those of *Œcophyilla*, the web being produced by the larvæ of the ant. It is probable that many other nest-building ants employ the same means, as no adult ant has any spinning organs.

The *Coleoptera* are treated very fully. The section renders useful assistance in the determination of the different families of this huge order of insects.

The section of *Lepidoptera* naturally occupies considerable space, and contains some useful life histories. The directions (on p. 398) for recognising the caterpillars of the several families appear to be rather too positive. Numerous exceptions might be cited in nearly every case. It should be noted that, on page 495, a figure of what is really the larva and moth of the Pyralid *Hypsipyla robusta* (adapted from "Indian Museum Notes," Vol. I., Part I, fig. 3) has been unaccountably labelled *Cossus cadambæ*—a totally different insect—and tacked on to the description of this species. The caterpillar of *robusta* is common in Ceylon, where it bores in the terminal shoots of Cedrela and Swietenia (Mahogany). The original figure in the "Indian Museum Notes" was a reproduction of a drawing by the writer of this review.

Following that on the *Lepidoptera* comes a very well arranged and useful section on the *Diptera*, by F. M. Howlett. It is pleasing to find this much-neglected order so well handled and receiving the attention that is so badly needed.

The last section of the book presents the remaining order *Rhynchota*, which contains many of our most troublesome insect pests. Here, as with the *Lepidoptera* and *Hymenoptera*, the author has had the advantage of the volumes of the "Fauna of British India" series which he has supplemented by many original observations. On page 685, *Serinetha augur* and *S. abdominalis* are accused of cannibalism. In Ceylon, both of these species are preyed upon by the Pyrrhocorid bug *Antilochus nigripes* which so closely mimics the Coreid *Serinetha*. There are both red and ochreous varieties of both the *Serinetha* and the *Antilochus*. Is it possible that the supposed carnivorous habits of *Serinetha* have been mistakenly attributed to these species instead of to their mimic? *Serinetha* most certainly sucks fruits and seeds in Ceylon, and

sometimes swarms on the fruits of *Schleichera trijuga* as well as in the burst pods of the *Bombax*.

A number of more or less interesting "interludes" on such subjects as "Cosmopolitan Insects," "Attraction to Light," "Sex," "Myrmecophilous Insects," "Migration," etcetera, are dispersed throughout the different sections of the book.

A few obvious misprints are noticeable. The title of the text figure on page 58 should be *Stylopygia* (not "Styloygia"). On page 160 (first line of last paragraph) "hemopterid" should be *Nemopterid*. On page 322 (line 14), for "figs. 199, 200," read *200, 201*. The figures 1,d and 1,e (on Plate LXII) have been wrongly placed. On page 603 (line 5), for "Pl. LXIV," read *LXIII*. In the explanation of Pl. LXV, fig. 6, "Microsdon" should read *Microdon*. On page 653 (line 13), for "disturbed" read *distributed;* and, on page 655 (line 16), the word *parent* has somehow been transformed into "present.'

A word must be said about the Plates and text figures with which the volume is so profusely illustrated. Some few have been taken over from the now defunct "Indian Museum Notes," but the majority of them are from original drawings prepared expressly for this publication. In the author's "Acknowledgments," it is stated that "those marked F. H. M. have been drawn by Mr. Howlett. Where not otherwise acknowledged, all the plates and illustrations are the work of the Artist Staff of this Institute under my or Mr. Howlett's direction; it may be pointed out that these artists are wholly natives of India, trained in Art Schools of this country; it is needless to emphasise how much the book owes to their beautiful work as also to the enterprise of the publishers, who have done the work of reproducing all the illustrations in this country. I wish to specially express my appreciation of the work of Mr. Slater of the Calcuttta Phototype Company in the printing of the Colour Plates."

The figures are not all of equal merit; but, with a very few exceptions, they serve their purpose sufficiently well, and very many of them are quite admirable. Of the coloured plates, Nos. VI, IX, XIV, XXXVI, XLIX, LXVI, LXVII, LXXII, and LXXV, may be specially commended as beautiful examples of tricolor printing and faithful representations of the objects portrayed. The upper part of Pl. XVI—representing the *Cicindelidœ*—is not up to the standard of most of the illustrations. The figures give no suggestion of the splendid metallic tints of these graceful beetles. The limbs—as shown—are too thick and clumsy, and have an exaggerated appearance of hairiness. On Pl. XXVII, figure 6 is represented as a typical Sphingid larva. This selection is unfortunate, as—without the definite statement in the explanation—it would have been difficult to recognise it as a Sphingid. It would have been easy to choose a more characteristic representative of the family.

Amongst the black-and-white illustrations, it is impossible to avoid singling out some of Mr. Howlett's clever drawings, *e.g.*, figs. 33, 60, 76, 141 and 151, in which there is a happy combination of clearness, accuracy, and artistic feeling. Special mention, also, must be made of R. C. Wood's dainty tail-piece at the end of the volume, in which the action of the swimming toad has been very cleverly caught. Of the other figures, Nos. 10, 36, 131, 154, 172, 179, 196, 284, 285 and 380 may be cited as good examples in various styles of treatment. Reference has already been made to the admirable reproduction on page 231. Fig. 152-A. on page 267, taken over from a continental author, is represented in the 'negative' style adopted (for what reason I do not know) by certain specialists in *Coleoptera*. The insect illustrated is in reality deep brown, with two ochreous (or reddish) patches on the elytra; whereas, in the figure, the colouration appears to be reversed.

A useful index brings a useful volume to a satisfactory conclusion. Mr. Lefroy and his coadjutors must be heartily congratulated upon the result of their labours.

E. ERNEST GREEN.

GUMS, RESINS, SAPS AND EXUDATIONS.

THE PASSING OF FICUS ELASTICA.

(From the *India Rubber Journal*, Vol. XXXVIII., No. 5, September, 1909.)

Four years ago the question of the relative advantages of planting "Hevea brasiliensis" (Para rubber), or "Ficus elastica" (Rambong), was considered an open one, and the fact that the latter was a native tree and grew freely in Malaya induced some to prefer it to the Brazilian plant. There are various difficulties attending the treatment of Ficus in regard to pruning it or allowing it to form its aërial roots unchecked, in relation to tapping and prevention of entrance of boring insects and fungi into the wounds; also the direction and shape of the branches and stems make the collection of latex no easy matter. The yields of dry rubber from rambong are larger than from Para and market prices excellent. The symmetrical stem of the Para, the facilities for running the latex into a single cup at the base of the tree, regularity of its growth and its reaction to a wound, have especially commended this tree to the rubber grower, so that rambong is no longer considered as an alternative on equal terms, and no further estates have been planted with the native plant. From a practical planter's point of view this choice must perhaps be considered wise; but it is to be regretted that a tree yielding so well and suited to local conditions should have been entirely abandoned. I have been carrying on experiments for some two years past in regard to the proper methods and instruments for tapping "Ficus elastica" (Rambong), and consider that a rotary pricker in which the pins are at such a distance apart that the latex which runs from the puncture joins that from those adjoining is a more practical way of extracting the latex than the making of a cut with a knife. If the rubber which flows from the various punctures made with a roller pricker all over the surface of the stem and branches is pulled off directly it has coagulated, it will be found that the flow will occur again and a second crepe-like film of coagulated latex can be pulled off. The absence of wound prevents the attacks of borers and the tree can be again pricked after a short time has elapsed. When the flow from the puncture is too great to allow it to coagulate and it runs down, it can be caught at the base of the tree by means of rubber band or a metal ledge round the tree to lead the latex into a cup or other receptacle. If a flow of latex is preferred to the crepe-like scrap I have described, then an application of water by a brush or spray will run the latex down to the base of the tree where it can be caught.

These questions are, however, becoming of minor importance in the Federated Malay States, as the passing of "Ficus elastica" has begun, and each year sees less of this interesting and profitable tree cultivated.

THE GUAYULE RUBBER INDUSTRY.

(From the *Indian Trade Journal*, Vol. XIV., No. 178, August 26, 1909.)

Mr. J. E. Kirkwood writes as under to the *Scientific American* :—

The increasing demand for rubber in the various manufactures of the present time makes the business of its production one of the most important of modern enterprises. Not only is the natural source of the supply eagerly sought and carefully guarded, but efforts for the cultivation of rubber-bearing plants are receiving attention in many parts of the world.

The rubber of commerce is derived from a number of different plants; in fact, there are many plants of more or less importance from the standpoint of the quantity and quality of the rubber they produce. Among those less generally known is a Mexican plant, called *guayule* (pronounced *gwyulie,*) which is identified botanically as *Parthenium argentatum.*

The guayule is a desert plant. It thrives in those regions of relatively little rain throughout the northern half of Mexico and the neighbouring areas of Texas. It is a small shrub, tree-like, and rarely attains a height of four feet or a stem diameter of more than three inches. Its leaves are small and of a silvery grey colour, whence its specific name *argentatum.* The plant produces small yellowish-green flower heads consisting of many minute florets, only five of which in each head are capable of producing seeds, and each of these only one.

Most of the rubber of commerce is produced by plants having a milky juice, or latex as it is called, in which the gum is found. The trees are tapped by cutting into or through the bark, and the latex is collected as it flows down. In the guayule plant no latex is produced, and it must be subjected to an entirely different process to extract the

rubber. This article occurs in the form of minute microscopic granules deposited throughout the tissues of the stem, branches, and roots, but especially in the bark of these organs. If one will take a very thin section of the stem or branch and examine it under a lens, he may see much of the tissue densely crowded with small, dark coloured granules. In these granuels, deposited within the living cell, is the source of the rubber, to separate which requires a special process.

Methods of extraction of guayule rubber differ. Some obtain the rubber by trituration of the plant and a subsequent more or less mechanical process; others by means of solvents separate the gum from tissues after grinding them. But the details of the process are kept secret, the public not being admitted to the factories, which are surrounded by high walls with armed guards at the gates. However, several processes are described by Dr. F. Altamirano in the *Boletin de la Secretaria de Fomento of Mexico*. One of the methods consists in first crushing the plants by grinding them in a machine, in which they are tumbled among hard stones until thoroughly pulverized, and the gummy substance collects in lumps with a certain amount of woody tissue. To isolate the gum, this material is then boiled over steam in an iron vessel with a double bottom, and the woody particles afterwards strained out. After this operation the mass is thrown into a tank of cold water; again it is strained and boiled anew with caustic soda until the woody particles are fully separated, and the gum is precipitated by chloride of calcium.

The process of extraction of guayule rubber involves therefore the immediate destruction of the plant. The natives employed to collect the plant uproot them, and take no pains to spare any parts. The bushes are then packed on the backs of burros, and carried to some place for baling and shipment. The cheapness of labour makes it feasible to transport the plants for considerable distance by pack train or wagon. Sometimes the load is carried for as much as forty miles from where the plant is gathered to the railway station, such distances usually by wagon. The cheapness of labour makes such operations profitable, the wages of a peon being about thirty-seven cents a day, Mexican currency.

The manufacture of rubber from guayule is an industry of only recent development. The production of gum from this plant has been known from the middle of the eighteenth century. The Indians were accustomed to make rubber balls by chewing out the gum from the bark. If one takes a mouthful of the bark and thoroughly masticates it, rejecting the fibrous particles, he may soon obtain a small mass of rubber the size of a pea. The rubber thus obtained is soft and sticky, adhering to the skin as it is manipulated between the thumb and finger.

For some time no effort was made to manufacture this rubber on a large scale. In 1890 a German chemist first attempted to extract it in commercial quantities, but a paying basis was not reached until some years later. In 1905, according to consular reports, the guayule rubber shipment from Durango amounted to $125,478. From Torreon in 1996 rubber was shipped to the value of $917,571. During the year ending in June, 1908, there was shipped from the Durango consular district alone, guayule rubber to the value of two and a quarter millions. Since then the business has increased, and is one of Mexico's most important industries at the present time. Extensive tracts of land and millions of capital are involved in the enterprise. The Continental-Mexican Rubber Company of New York, in addition to their large factory at Torreon, acquired possession of the old Hacienda de Cedros in the northern part of the State of Zacatecas, consisting of 2,500,000 acres, valued especially for the growth of guayule which it supports. The Madero brothers of Barras are said to own or control 3,000,000 acres of guayule lands, and there are other large interests besides these.

The rate of consumption of guayule is a subject of interest and importance. With several well-equipped factories in active operation working, at least a part of the time, both night and day, the inroad upon the supply is a matter demanding consideration. Although the acreage above cited seems large, the fact is that only parts, favoured situations, of these large holdings actually produce the plant—the foothills especially, of limestone formation. A single factory may consume 30,000 tons of guayule shrub in a year, or approximately 100 tons a day. This may represent the growth on anywhere from 25 to 100 acres of land. The number of plants on an acre, and the weight of the individual plant, vary so much that no constant figures can be given. One may find on guayule lands a stand of from 1,000 to 2,000 plants to the acre, and the plants weigh anywhere up to 15 pounds (very large); probably the majority of the plants

taken weigh dry from 1 to 4 pounds. Thus on an acre we should find from 1,000 to 8,000 pounds of the shurb. If we call the average yield two tons per acre, we may estimate the area harvested at fifty acres for one day's consumption at a large factory.

While the fact is patent that the supply of guayule is decreasing and must ultimately be exhausted, the opinions of experts place the date, some at ten, some at twenty years hence. Large factories running steadily at Parras, Torreon, Saltillo, and elsewhere, using the product of no less than 100 acres every day, the activities of the camps which the traveller may see in dozen places in a day's journey; the bales of the shrub piled high by the siding awaiting shipment, all point to the speedily approaching day when the factories must shut down for want of material.

This menace to the business interests involved has not been overlooked cr ignored. To provide a continuous crop upon which the business could depend is an idea that has appealed, not only to the members of interested corporations, but also to private land-holders, who appreciated the income prospective from such an enterprise. Experiments here and there have been tried, and various opinions have taken form as to the prospect. The most notable of these experiments was that conducted at the instance of the Continental-Mexican Rubber Company, who recently established an elaborate department of investigation at Cedros, Mexico, and spent much money in forwarding the work. Although less than a year was allowed for this large task, the time sufficed to show some insuperable obstacles to the cultivation of the plant on any thing like an economic scale.

In the first place, the slow production of seeds, and the care required in their planting, and the rearing of young plants, make the procedure unprofitable from an economic stand point. With a possible germination rate of 10 per cent. of the seed sown, the failure through one cause or another of the young seedlings to pass the initial stages of development, the ranks of the young plants again depleted by pest or parasite, the loss by accidents or in process of transplanting, and a few subsequent vicissitudes both possible and probable, make it doubtful whether one can count on as much as 1 per cent. of the seed sown to mature plants, even under the most favourable conditions. Cuttings mostly fail to grow except from portions of the roots, or stems having part of the root system in connection with them, and only under certain conditions of irrigation; even then, as in the case of seedlings the cost of the operation exceeds its value. Irrigation is quite essential to the starting either of seeds or cuttings, and in the subsequent growth the rapidity of development depends upon the quantity of water supplied.

But the rapidity of development is in inverse ratio to the formation of rubber in the tissues. Plants grown under irrigation grow rapidly, and attain in four years a weight of six pounds or more, but the rubber content in such plants is practically *nil*, while in native desert-grown plants it is about 10 per cent. of the dry weight. If, however, water is withheld, as under desert conditions, the plants grow very slowly, and it is doubtful whether a crop could be matured much under twenty years. Of course, rubber is present in desert-grown plants at an age much less than this, but it is a question at what age plants may be most profitably taken, though certainly not less than ten years.

Reforestation by natural processes must be very slow, and as in the case of the lumber forests of the North, the second growth is never equal to the first. A guayule seed in the desert has about one chance in the thousand of coming up, and thereafter danger from drought, disease, and accident make its hold upon life exceedingly uncertain. The only hope of prolonging the business seems to be in so harvesting the plants that the roots are left in the ground; from these new shoots will arise, and in a few years possibly yield another crop worth the taking. How long this process can be kept up profitably is at present unknown. However, the guayule rubber industry seems destined to have its day and pass out.

The above statements are issued only after much observation and experiment, the details of which are soon to be published in a book under the joint authorship of the investigators.

RUBBER PRICE CONDITIONS.

(From the *India Rubber World*, Vol. L., No. 2, May, 1909.)

The topic of the utmost interest in the india-rubber industry to-day, and that which is most considered, is the present and prospective price of crude rubber. Whether the manufacturer be located at Malden, Manchester, Mannheim, Melbourne, Menin, Milan, Mjondalen, Montargis, Montreal, or Moscow, the question is ever present, as one which

must be taken into account in planning every detail for the future. This is a fact which makes the whole rubber industry akin, for the price of rubber everywhere at any moment practically is the same, while the same uncertainty exists as to what the price may be to-morrow. The producers of rubber and the traders in rubber have troubles of their own in relation to the same subject, but here we shall treat more particularly of the manufacturers. Where rubber prices are made, or how they are made, are questions not now pertinent to our purpose. The uncertainty of prices is the thing, and what the consumer of rubber can do about it.

Low priced rubber is not so essential. When every consumer of a given grade of rubber must buy it practically from the same source, and it costs them all precisely the same figure, they are all on the same footing. Whether the cost is 50 cents or $1 a pound, or more, would be immaterial—if permanent prices could be counted upon. But they cannot. The average price at New York of fine upriver Para rubber during the year 1902 was 76 cents; during 1905 it was $1·28½, since then it has been less, the figure for 1908 declining to 93¼ cents. This year, so far, the price for this grade has kept in the neighbourhood of $1·20. When it is considered that the difference between the highest and lowest year prices here quoted amounts to no less than $1,157·42 cents per metrical ton, and that these fluctuations usually occur without warning, the buying of raw rubber by consumers approaches almost a speculative basis.

The producers of rubber in the Amazon region, far from satisfied with a condition under which they have no say in fixing the market price of their produce, have determined upon a course of action, in which, with the help of the Government and of a great bank, they mean to hold their rubber whenever prices are not high enough to be attractive. Now the holding of rubber anywhere is an expensive practice, when storage costs are considered, insurance, interest on advances—and the inevitable shrinkage in weight. It is well enough to speak of rubber as being a modern necessity, but there are limits to what people will pay even for necessities, and manufacturers would have to halt somewhere in the matter of paying advancing rates on rubber, even were the Amazon region the world's only source. There would be an inevitable check to rising prices, due to increased production and the hesitation of consumers to buy, after which the banks would have to unload, with such results as followed Vianna's state-aided rubber "corner"—a fall to half the former prices and loss to everybody concerned.

The *India Rubber World*, a dozen years ago, printed an article on "What Vianna did for African Rubbers," showing that his speculative "bearing" of the market for Para rubber opened the way largely for the increased use of African grades. Nowadays, African rubbers having won an established position in the industry, though now apparently falling off in the rate of production, an important new source of supplies has been developed—the Eastern plantations, the product of which (*Hevea*) is better calculated than even the best Africans for supplanting the Amazon rubber in the industry.

Without meaning to advice our friends on the Amazon, it would seem that their best interest lies, not in forcing up prices to an artificial level, but to so improving their business methods as to enable them to sell at a profit at even lower prices than at present. Their devotion to any policy gives the planters of Ceylon and Malaya, backed by unlimited European capital, the very encouragement which they want and most need. The Eastern planters have it in their power to appeal strongly to the consuming markets in the matter of guaranteeing prices for longer periods than have ever been known in the trade before, and we shall be surprised if this does not strengthen the demand for their product.

YIELDS OF DRY RUBBER PER TREE.

(From the *India Rubber Journal*, Vol. XXXVIII., No. 5, September, 1909.)

It is difficult to decide whether it is better to record yields per acre or per tree; both methods are in some ways misleading. The yields having been given in my last report per tree, this seems to me to be the better way to continue. The average yield per tapped tree all over the Peninsular has risen from 1 lb. 12 oz. to 1 lb., 15¾ oz., an increase of 11 per cent. Considering that the majority of the trees tapped are in their first year of bearing, this is a most encouraging figure and shows that the yields estimated in looking forward to the future production of rubber trees have, as a rule, been extremely moderate if not unnecessarily small. The average yield of tapped trees, in Negri Sembilan, amounted to 3 lb. 2¼ oz., which, being the average of nearly one million trees, is an extraordinarily high figure. This State has much higher yields per tree because the proportion of trees in

their first tapping period is much less than in the other States, but this high figure is interesting as pointing to the averages which may be looked for in trees after two or three years' tapping. An interesting tapping experiment with eight 17-year-old trees, growing round the churchyard at Parit Buntar, in the Krian district of Perak, has given after one year's tapping every other day an average of 28½ lb. of dry rubber per tree. The average girth of the trees was 54·87 inches at three feet from the ground, and they had been growing in unweeded land containing lalang and other grasses.

COMPARATIVE TABLES OF RUBBER CROPS, MALAYA, 1907 AND 1908.

State.	Number of trees tapped. 1907.	1908.	Rubber yields. 1907. lb.
Selangor *a*	772,656	1,172,383	1,131,086
Perak *a*	132,556	251,613	272,804
Negri Sembilan *a*	240,401	306,376	586,864
Pahang *a*	—	—	—
Malacca *b*	12,455	56,846	34,490
Province Wellesley *b*	48,000	65,100	82,131
Johore	94,159	101,772	182,495
Kelantan	—	—	—
Total	1,300,227	1,954,090	2,278,870

State.	Rubber Yields. 1908 lb.	Average yield per tree. 1907 lb.	oz.	1908 lb.	oz.
Selangor *a*	1,846,384	1	7½	1	91·5
Perak *a*	383,073	2	1	1	8¾
Negri Sembilan *a*	963,253	2	7	3	2½
Pahang *a*	—	—	—	—	—
Malacca *b*	52,980	1	14	—	—
Province Wellesley *b*	92,600	1	11	—	—
Johore	201,632	1	15	1	15¾
Kelantan	—	—	—	—	—
Total	3,539,922	—	—	—	—

In Province Wellesley is included two estates in Singapore, eight estates in Penang, and five estates in Kodah.

a F.M.S. *b* S.S.

OILS AND FATS.

POSSIBILITIES OF COTTONSEED OIL.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 9, September 1, 1909.)

In the course of an article in the *Cottonseed Oil Magazine*, U. S. A., Mr. F. A. Southwick writes :—It was stated by a speaker recently at the Interstate Cotton Oil Convention that cotton furnishes, among other things, a not inconsiderable portion of our daily food. This statement, while seeming mere rhetoric, contains a large grain of truth than would at first appear.

It is well known that by far the larger part of all the salad oil sold in this country to-day is made from cottonseed oil. Cottonseed oil enters largely into medicinal preparations, and, in fact, wherever an edible oil is used it is pretty sure to be cottonseed oil. Cottonseed oil is replacing to a remarkable extent the hog product for cooking and baking, not only in the large wholesale establishments, but in our homes and kitchens as well. Probably the most promising field for cottonseed oil is the oleomargarine industry, provided that industry could free itself from the shackles of adverse legislation, which ostensibly placed on the statute books to protect the farmer and small dairyman, in reality operates to bolster up the product of the "butter trust," robs the farmer, cheats the government out of millions per year in revenue, deceives the people and is rapidly building up a large and affluent class of moon-shiners, who are the real pirates of the oleomargarine business.

With commendable foresight the recent Interstate Convention placed itself on record as favouring a repeal of the present oleomargarine law, and it is to the interest of every one in any way identified with the cotton oil industry to work for that end, because if the consumption of oleomargarine in America were allowed to equal that of foreign countries, where the only legislation is to prevent it being sold for anything except what it really is and under its own label, it would mean a demand for cottonseed oil more than double the present total output.

According to statistics the output for last year of cottonseed oil in this country was 1,200,000 barrels for domestic consumption. Had our consumption of oleomargarine been even equal to the little principality of Holland, which has a population of a little over two million

people, and which, I think, will be conceded, is a fairly intelligent country, it would have required on the present basis of formula for making oleomargarine 2,370,000 barrels to take care of the domestic demand for oleomargarine alone, to say nothing of the demand for other purposes, which takes now probably about a million barrels.

When these facts are considered it is easy to see why the oleomargarine question received such a warm reception at the Memphis meeting, and why it is that cottonseed oil crushers are heartily in favour of a repeal of the present oleomargarine law, aside from the fact that every true American citizen is opposed to the law because it does exactly what our constitution says cannot be done, that is, taxes one class for the benefit of another, and with one hand uses the taxing power of the government to tear down one industry, while the other hand is building up what will some day be a most formidable and pernicious trust, as it has already shown itself to possess all the elements to bring about that result.

The writer was recently approached by a party in the East who claims to have discovered a process of refining cottonseed oils, rendering them sweet and palatable at what he states, is much lower cost than is possible with present methods. I have not had the opportunity yet to investigate his processes as I shall do later, but the information leads me to state for the benefit of the cottonseed oil chemists that if they could produce an oil which would be absolutely neutral in tests and smell, they would find a much larger market for this oil than they now do.

In the manufacture of oleomargarine, for instance, about 30 per cent. of cottonseed oil is used, and the only reason why more of it is not used is because of the fact that that is about all the product will stand without disclosing itself on account of the peculiar taste which it seems hard to get out of the oil. For the manufacture of oleomargarine a pure neutral oil is essential, and when this is discovered or produced it will find a ready sale. Another item which may be of value to the cottonseed oil chemist is that if he could produce an edible oil without destroying the crude colour, or if he could have that colour a red gold tint, it would open up an entire new market and would bring a good price.

It is well known that at present the refining of cottonseed oil takes its colour out along with the objectionable taste, but if this taste could be removed and the colour left, I believe we should have a product which would revolutionize the industry of oleomargarine making, which industry is rapidly increasing and will increase still faster whenever it can get the proper materials to produce it.

PRESERVATION OF MIXTURES OF SESSAMUM AND GROUNDNUT OIL.

(From the *Indian Trade Journal*, Vol. XIV., No. 181, September 16, 1909.)

In "Leaflet" No. 18 issued by the Department of Agriculture, Burma, it is stated that there appears to be, in certain parts of Burma, a belief that sessamum oil and groundnut oil undergo spontaneous decomposition or fermentation when mixed; the idea apparently being that one or other of these oils contains some active principle which, though harmless to the oil containing it, brings about decomposition in the admixed oil.

This belief is not well founded. Experimental tests prove conclusively that no rancidity, gas formation, or deposit of any kind occurs in a mixture of the two oils, provided it is kept in clean vessels. Tubes containing sterilised oil and unsterilised oil cannot be distinguished from one another by any means even after they have been kept standing for three months. In no case has it been found that any decomposition has taken place. It is clear therefore that the mixed oil is not liable to spontaneous fermentation, and that where such fermentation takes place, it must be entirely due to the infected vessels in which the oil is stored.

Doubtless oil-dealers, who have suffered loss through decomposition of their stock, have made efforts to clean their vessels. It is, however, unfortunately a difficult matter to clean a vessel which has contained oil, more especially if it is to be cleaned to such an extent as to remove bacterial infection. It would be quite impossible to clean an earthen vessel to this extent if it were not thoroughly glazed. A well-glazed vessel may be cleaned with soda or with some good varieties of "sat-pyamye" followed in either case by a liberal use of hot water. It is not desirable that any chemical disinfectant should be added to preserve the oil. The experiments carried out have shown very distinctly that it will keep well in clean vessels.

The use of a great deal of water in the process of expression of either sessamum or groundnut oil may account

for its decomposition in some cases, because the water retained by the oil affords a suitable medium for bacterial development. Although, therefore, a certain amount of water may be found necessary for carrying out the expression process, its use beyond the necessary minimum should be avoided as an adulteration and as likely to result in the decomposition of the oil.

FIBRES.

COTTON IMPROVEMENT IN MADRAS.

(From the *Indian Agriculturist,* Vol. XXXIV., No. 4, April 1, 1909.)

The Government of Madras have approved of the proposals of Mr. M. E. Couchman, Director of Agriculture, for the utilisation of the Budget grant of Rs. 5,000 for the improvement of cotton. These refer to work under the following three heads to be carried on mainly in the Tinnevelly District, and to a small extent in Trichinopoly :—(*a*) Collection and distribution of pure "Karunganni" seed last season; (*b*) growing pure seed of the "Karunganni" variety for distribution to the ryots next season; and (*c*) the introduction of the use of the seed-drill and bullock-hoe of the Telugu Districts. Mr. Couchman's investigations have led him to the conclusion that "Karunganni" cotton is much superior to "Uppam," and he is doing all he can to promote the growth of the former variety by buying up pure seed and distributing it among the ryots. He obtained enough of the seed last year to sow about 7,000 acres, and as he could have sold much more had it been available, he has decided to open seed farms on about 250 acres of ryots' land. The total area on which seed is being grown for the Department this year by private persons is 263 acres; and as Mr. Couchman says, it reflects much credit on Mr. Sampson, Deputy Director of Agriculture, Southern Division, that he has been able to overcome the suspicions of the ryots and induce them to co-operate with the Department on such a large scale.

We have already called attention to the success which has attended the introduction of the Tinnevelly ryots to the seed drill and connected implements of the Telugu country, the advantages of which, Mr. Couchman says, are becoming widely appreciated. Mr. Sampson is also a great believer in this method of sowing, for he writes :—"The introduction of this system of cultivation is, I consider, the most important work that is being done. In seasons of drought such as this the ryot has to depend almost entirely on his cotton crop for his livelihood, and if it can be shown that this system of cultivation can help the cotton crop to withstand the drought and to give even a fair crop in such seasons, it may mean all the difference between scarcity and famine." One thousand acres have been sown with the drill this year, of which about 400 acres are situated in the village in which the Koilpatti farm is situated. The points which strike the ryots are that, with the drill, a much larger area can be sown on a given time than with the plough, and that sowing can be continued for a longer period after the rain stops. Many fields sown in the time-honoured fashion are said to have entirely failed this year, while others sown with the drill have given a fair stand, and some again are said to be better than those of the Agricultural Station. Hitherto, trained coolies have been employed to show the ryots how to use the drill, but now not only have the latter themselves learned how to drive it, but they have also taught their womenkind. As regards cotton improvement in the rest of the Presidency, a quantity of good cotton seed has been distributed in the Bellary and Kurnool Districts, but the expenditure for this has been met from the Budgets of the Agricultural Stations in those Districts. The Board of Revenue also enquires whether any portion of the grant that will be provided next year cannot be devoted to the improvement of the cottons of the Ceded Districts. The expenditure on the operations described above amounted to rather over Rs. 11,000, towards which Rs. 3,000 were contributed by the British Cotton-Growing Association.—*Madras Mail.*

JUTE IN 1908.

(From the *Indian Agriculturist,* Vol. XXXIV., No. 1, January, 1909.)

A DUNDEE REVIEW OF THE YEAR.

In a comprehensive review of the jute trade in 1908, the *Dundee Advertiser* remarks that to describe the year as critical in the industry would be strictly

in accordance with fact, and yet from a financial point of view the disasters or failures locally have been in an exceptional degree limited. This is to be attributed in some degree to good financing:—

Certain it is that the far seeing and judicious or mayhap lucky, manufacturer could emerge with a profit. His contemporary in the spinning department of the trade had not the same chance, for his trade obliges him to secure a portion of his jute in advance, and everybody knows what that signified in the current season. On the other hand, he had too often to sell his yarn in a glutted market, and take the best price he could get. It may be hinted without prejudice that the spinner who completes the year without loss has performed a greater feat than the manufacturer who nets his 5 per cent. or more of profit. Balance-sheets, as a rule, must present a sorry spectacle, and those who have come well out of the present year deserve to be congratulated.

UNITED STATES AND ARGENTINA.

If the situation here was bad, on the other side it was, if possible, worse, and as an instance of the unparalleled state of the burlap stock in New York, it may be mentioned that the warehouse accommodation was taxed to its utmost, and thousands of bales for which room could not be found had to be sent to Brooklyn. This will give a slight idea of the amount of reckless trading that had been in vogue. When the United States market, the most important for the consumption of jute goods in the world, failed to implement its contracts by asking their suspension until further notice, and when a considerable proportion of machinery was employed in the production of those goods, it is obvious that a crisis is arrived at. And the crisis was intensified by numerous other markets either delaying deliveries or cutting down their orders.

Dealing with the position of Argentina, the *Advertiser* remarks that at certain periods of the year Buenos Ayres bought largely, and, what was more, Calcutta, who is our arch competitor for the business, pursued on occasions a line of policy that suited Dundee admirably, and saw meet to adhere to a fuller price for ten-porter quality than her rival was quoting, and the latter most fortunately scooped thousands of bales. By and by there came a time when Calcutta began to realise what had been done, and took a rectifying step; still later news came of damage to the crop, and no Plate firm has had the hardihood to buy in bulk of standard hessians since. It is believed there will be a carry-over of some ten thousand bales. Calcutta exported 94,472 bales, so between Calcutta and Dundee the Plate receipts cannot be far short of 100,000 bales—a record by a long way.

It has been shown that Dundee now and again had the advantage in competing against our Indian friends for ten-porter hessians. Happily, where still lighter qualities are concerned, the advantage to Dundee is yet more decided, and is in fact becoming perennial. The reason of our light hessians being so systematically preferred to Calcutta make is that usually there are too many holes about the Calcutta goods, and other evidences appear of the work being driven through by some of the mills. As the outcome of this the large lots of 5½ to 8½ oz. cloth placed throughout the season by the United States, Scandinavia, South Europe, home trade, Canada, and West Coast of South America are coming more and more to Dundee.

THE QUESTION OF OVER-PRODUCTION.

In regard to the attempts made to restrict production the review states that unanimity among the Dundee millowners was hopeless from the first. A couple of mills have been dismantled, the one by fire and the other by the hammer, and the Dundee extensions, except in a couple of cases, have not been appreciable. The burned mill is being restored. Continental extensions have been considerable, and in Calcutta they have been so thoroughly overdone as to make it questionable whether the serious delay in the recovery of the jute trade is not due more to the immense increase in the volume of goods being manufactured in Calcutta than to the rate of progress in America, for, be it observed, that New York firms complain by every mail of the impossibility of getting business into a normal state, whilst their markets are being deluged by Calcutta's over-production.

Apparently, the review continues, there is now no doubt of the 1908-9 harvest being ample for all needs.

That Dundee got far more than she consumed last season there can be no manner of doubt, and that she is to have plenty of material in the current season is as unquestionable. Even in early June a 1*s.* rate was paid for warehouse room, and now the general figure is 1*s.* 6*d.* per ton per month. Every one who looks sees how warehouse accommodation has been augmented in the last few years, and with it all and the manifold additions built this year ware-

housing is at a high premium, and the fortunate possessor of one or more coins money. Every place is packed full, and no building, however out of the way, is allowed to stand empty. It is the turn of the holder of warehouse room, whose trading profit is to be envied at the end of 1908. And in the immediate future the rate threatens to rise. It is rumoured that more has been given. Even cattle-sheds have been requisitioned.

BAD JUTE SHIPPED.

In alluding to the quality of the jute received, the *Advertiser* declares that deterioration rather than improvement has to be recorded. The great bulk has been an honest, well-selected, well-manipulated tender, but a heavy proportion has been just the opposite. How balers will go on baling, and shippers go on shipping material that will bring them into trouble, it surpasses the wit of man to say. Many a severe lesson was received last year, and still the same abominable work continues. It is a pity this cannot be cured, as the watering was. Invoicing back is a pretty drastic remedy, but it fails to have effect. The loss is so serious in a season like this that, possibly when the determination of the trade to put down and stamp out this sort of conduct is seen, amendment will be made, and next year will be better. The estimable endeavour on the part of the shippers to bind down the balers not to have more than 2½ per cent. of root was a step in the right direction, and the sending out to Calcutta of sample bales as a standard of quality was another; but there seems to be a difficulty in getting these conditions and standard worked to unless at a higher price, and the arranging of this has its drawbacks.

For a time the first-mentioned scheme worked admirably, and jute was being landed here £2 per ton superior to the same grades baled earlier in the year. The improvement noticeable fell away, but it is to be more rigidly adhered to in future. The shoal of arbitrations this year has been dreadful, and six or eight of the marks, or the owners of them, have had the due reward of their misdeeds meted out. What is it called when a baler thrusts fibre 40s. per ton inferior to the mark into the bale he is packing! To imagine that it will not be detected is hopeless. Thousands of pounds have been spent in arbitrating, and that is not the worst of it, for the spinner, whose jute it is, finds it most inconvenient to be obliged to do without the jute or substitute another parcel for it. He often has it brought home to him that the transaction was most profitable. So as to protect themselves as far as possible consumers got much more into the habit of buying a reputed first mark on whose soundness and good quality reliance can be placed.

In conclusion it is stated that the year was passing out amid irregularities of price, which indicate that an over supply of yarns exists. The remedy that tells most unobjectionably is short time working. An example of concerted action has been shown by Calcutta, but efforts to have it copied in Dundee have been frustrated.

SISAL PLANTING IN GERMAN EAST AFRICA.

By A. E. F. FAWCUS, Reweru.

(From the *Agricultural Journal of British East Africa,* Vol. II., Part II. Quarterly, July, 1909.)

In view of the widespread interest now being shewn in this country on the cultivation of Sisal, and considering the high state of development to which the Germans, in their East African Colony have brought this industry for commercial purposes, it may be of interest to those in this country who have either sisal plantation in being, or who intend to start planting sisal, to hear something about the methods in which the Germans have laid out and are working their plantations, and of the results they are obtaining therefrom.

SOIL.—The soil preferred by the German sisal planters is of a red to chocolate colour and a light friable nature, and I think that it is admitted amongst sisal planters that a slight admixture of lime in the soil is a *sine qua non;* and it would be advisable for sisal planters in this country who have no lime in their soil to mix in a small quantity around each plant.

CONFIGURATION OF LAND.—The configuration of the land should be of a hilly nature so as to allow of easy drainage, as a water-logged or clayey soil is extremely detrimental to sisal.

PREPARATION AND CULTIVATION OF LAND.—In some cases the German planters have only cleared and burnt the scrub, bush, grass, etc., on the land and have not hoed the soil at all before planting; after planting they skim the land lightly with a jembe. But these plantations are not to be compared with those which are well hoed and cleaned to commence with; the plants on the latter grow to a much larger size in the

same space of time and give a much greater percentage of fibre, and in addition to these two important factors the quality of the fibre is superior. The plants in a badly cultivated plantation are very small and yellow instead of being large and of a bluish colour. On one plantation near Tanga, which was too large for the owner's means, and consequently the weeds thereon had been allowed to run riot, I saw 4-year old plants which were certainly not more than 3' 6" high, while on well-kept plantations, I saw 3-year old plants 7' 7" high. Sisal is a plant to which plenty of sun and fresh air are absolutely essential, and if shaded at all the fibre becomes weak and is not strong enough to keep the leaves rigid, and these in consequence collapse. The cost of clearing, hoeing once and planting varies from Rs. 70 to Rs. 150 per hectare (1 hectare = $2\frac{1}{2}$ acres approx.) Four to five light hoeings per annum are necessary to keep the land free from weeds.

PLANTS.—Propagation of sisal takes place in two ways, viz., Bulbil and Rhizome suckers.

Bulbils are small plants which appear on the branches of the pole of the main plant replacing the flowers after the latter have withered; sometimes as many as 4,000 have been picked from one plant.

The pole of the sisal plant only appears when the life of the plant is ending and grows to a height of about 20' 0". From a commercial point of view the bulbil is not as satisfactory as the sucker, because it takes at least six months longer to reach the age of maturity, but when long distance and expensive transport are necessary, the practicability of planting the latter in large numbers would hardly be possible on account of its bulk and weight,

The sucker is a young plant shooting from the rhizomes or underground stems of the parent plants. Where there is a shortage in the supply of young sisal it is advisable to cut these off the rhizome as soon as they appear above ground and put them in nurseries, because if the suckers are allowed to grow on until they are ready for planting in the fields, they take up much of the strength of the main plant, which would otherwise be utilised in producing new suckers. An interesting and useful fact to planters in British East Africa where the supply of young sisal plants is limited, is that if the rhizome is pulled up and cut into small pieces and then put into well-watered nurseries, nearly all those pieces will develop into plants.

The Germans generally plant out their suckers when they are twelve inches or more high; before planting, all the roots and small base leaves are cut off.

PLANTING DISTANCES.—Although as regards planting distances, many experiments have now been made, the average and also the general planting distances, now used for sisal in German East Africa are $2\frac{1}{2}$ meters between rows and $1\frac{1}{4}$ between plants which are practically equivalent to 8′ 0″ × 4′ 0″. These distances give approximately 1,300 plants to the acre. They have now entirely given up the practice of planting between the old rows at the end of the third year as it has been found that the intermediate rows do not grow at all well as the first series of plants exhausts the soil too much. Now, after the plants have poled, the land is allowed to be fallow for three years, while another part of the plantation which would then have reached the age of maturity is being worked.

LAYING OUT PLANTATION.—Where possible it is often economical and advantageous to have the factory near to the centre of the plantation, but in many cases this is not practicable, and in cases where the plantation is bordered on one side by a river the balance of advantages weighs towards having the factory by the river. However, with regard to this matter it is quite impossible to lay down any hard and fast rule as local conditions such as railways, rivers, slope of land, etc., must be taken into consideration.

When laying out a plantation it is necessary to consider very carefully the site for the factory and the spaces to be left for tram lines, these latter are an absolute necessity and cost approximately £240 per mile, so both from the point of view of capital cost and of economical working it is advisable to lay out tram lines so as to be of as short a distance and to command as much area as possible.

On some plantations I visited the fields were divided by roads into ten hectare (about 25 acres) blocks. This was done to allow greater facility in administration, but unless a remunerative plant, such as Ceara rubber or Coffee or Cocoa is grown along these divisions, it means a great deal of unnecessary expense in cultivation and weeding, and is by no means necessary. Of course a certain amount of water is required for the preparation of sisal, but quite a small quantity will suffice, although a good supply of about 500 gallons an hour is desirable.

In some cases in German East Africa I believe the washing tanks are filled

during the night and the water therein has to suffice for the whole day, whilst in other cases where the water supply is plentiful there is quite a good stream running through the factory and taking away the waste.

CUTTING OF LEAVES.—The plant is ready to commence cutting at the end of the year when about 40-60 leaves can be cut, leaving 15 or 16 on the plant. Afterwards the first cutting takes place every 8 or 9 months when 20-25 leaves are cut each time.

The average number of leaves per plant is 150-170, and the age of the plant seven years.

The knife generally used for cutting the leaves is a fairly large Bushman's friend, which must be kept sharp.

One boy can cut from 1,000-1,500 leaves a day.

After cutting, the labourer trims off the sharp point at the end of the leaf and runs his knife down the two sides of the leaf to trim off any spikes there may be, and also to roughen the sharp edge of the leaf so that they do not cut the hands of the boys feeding the decorticator.

The leaves are then bound into bundles and carried to the nearest trolley where they are loaded up and sent off to the factory.

THE FACTORY.—It is a very difficult matter to make any hard and fast rule as to the design of a factory as every planter has his own ideas and whims on this subject, and in no two cases did I see factories laid out in the same way. I shall therefore merely give a rough sketch shewing the plant of what is said to be the best and most up-to-date factory in German East Africa; this has only lately been completed, and has to deal with a plantation of 1,675 acres of sisal. One steam engine of 75 N.H.P. worked the whole of this plant.

DECORTICATORS.—The three decorticating machines chiefly used in German East Africa are the Mola, the Finnigan-Zabraski and the Neue Corona. The main principle of all these machines is the same, there are two scutching wheels revolving opposite ways, and the leaves being fed into the machine are machanically held, whilst the first scutching wheel cleans half the leaf, they are then automatically passed on to the second wheel which scutches the other half of the leaf.

The Neue Corona is undoubtedly the most popular decorticator in use in German East Africa at the present day. It will turn out 2½ tons of clean fibre daily as against ¾ ton by the Finnigan-Zabraski and 2 tons by the Mola. The wear and tear on the latter of these is very great and the fibre is often very much damaged whilst being cleaned by this machine. The main objection to the Finnigan is the small amount of fibre it is capable of turning out per day.

On all these machines trouble is caused by the chemical action of the chlorophyll on the iron and steel.

There is also a machine called the Raspador; this consists of one scutching wheel only and is hand fed. It is very simple, but the loss of hands and arms from being dragged into the machine is very great. Ten of these machines will decorticate about one ton per day, but the amount of labour required for these machines is too great to be economical.

THE PROCESS OF SISAL MANUFACTURE.—After the sisal leaves reach the factory they are handed into the machine feeders either mechanically or by hand. The feeders then arrange leaves on a revolving belt which takes the leaves into the decorticator.

After the fibre has been decorticated it is taken to tanks which should be near to the machine to be washed. The waste from the leaves is either carried away on the land or into a river by a running stream, or if the supply of water is insufficient, by hoppers on a tram line placed underneath the decorticator so that the waste falls into them.

After the fibre has been washed it is hung out on strings to be dried; one day's really good sunshine will do this.

It is unwise to decorticate during the rains as the fibre takes a long time to dry and is liable to be packed damp; if it is packed damp the fibre blackens and is useless.

When the fibre is well dried it is taken into the brushing room and thoroughly brushed in high speed revolving brushing machines; by this means all the short strands of fibre are brushed out, and they form a second quantity of finished sisal which realises about £12 or £13 per ton which is used for stuffing chairs, etc. The sisal is now ready for packing and is pressed by a hydraulic press into a bale, it is then weighed; each bale weighs approximately 400 lbs.

PERCENTAGE OF FIBRE.—On a well-kept plantation as much as 4% or more of dry fibre is obtained, but on the average plantation I visited, in practically every case 3% was given as the percentage obtained; with this latter figure about

1½ tons of fibre was obtained per annum from 3,000 plants, but in the well-kept plantations 2½ tons per 3,000 plants was often realised.

Labour.—There is apparently a fairly plentiful supply of labour, most of which is Wanyamwezi, but the wages the plantation labourer receives are very high; for some time past the standard rate of pay has been Rs. 12 or Rs. 13 per month and no posho, but I understand from several of the planters that the present Government are now forcing the wage up to Rs. 15 per month. In addition to this, the planter must pay his boys for Sundays whether they work on that or not, and must also pay them full wages for any time they are absent through sickness.

Also a planter wanting a large gang of labourers has generally to send up-country for them, and is not allowed to take them on for longer than a six months' contract, and by the time he has brought the gang to his plantation they have cost him several rupees per head. By forcing the rate of pay up to such a high figure the Government is doing a great deal of harm, as the planters will now have to "sweat" their labour, a thing which has not hitherto been done.

But so pleased are the Germans with the results and prospects of their sisal plantations that, notwithstanding all these troubles they are now putting in many more sisal fields and are confident of their success.

They have found that the total cost of production and delivery f.o.b. Hamburg of one ton of sisal is a maximum of £15.

In conclusion I would say that there is no reason at all why parts of the Highlands of British East Africa should not become great sisal producing districts. We have, when it is properly organized, a plentiful and cheap labour supply, excellent soil and a very important factor, viz., oxen for ploughing purposes, we undoubtedly obtain a small percentage of fibre, but we obtain a bigger plant, and this only means we have to carry more leaves from our plantations to our factories, and the extra expense of this with cheap labour is not great, although there are more leaves to decorticate, they are more pulpy and easier to clean, and, finally, we have a delightful and healthy climate to live in.

DRUGS AND MEDICINAL PRODUCTS.

TRANSVAAL TOBACCO SEED BEDS.

By J. Van Leenhoff,
Government Tobacco Expert.

(From the *Transvaal Agricultural Journal*, Vol. VII., July, 1909, No. 28.)

Our tobacco planters in South Africa experience a number of difficulties in the attempt to produce first-class tobacco seedlings at a minimum outlay. During the past year or two some improvements have been made in this direction, but from observation it would appear that the majority of planters still stick to the old methods.

The following description of old and modern methods of preparing and treating tobacco seed beds may therefore be of some interest to planters, not only in the Transvaal, but also in the rest of South Africa.

The following recommendations are based upon a combined knowledge of:

(*a*) Applied methods in vogue in other tobacco-producing countries;

(*b*) The local conditions in South Africa in so far as climate, soil, labour, etc., are concerned, of which a careful study has been made during the past three years;

(*c*) The results of experiments carried out at Pretoria, Rustenburg, Barberton, and Zoutpansberg Tobacco Experiment Stations.

Old Methods.

As I stated in a previous article, in the Transvaal seed beds are usually made too early in the season. Beds made in April and May have to resist the cold months of June and July, and the seedlings are unable to make good growth if they are not well protected, and if germination and growth take place in the winter months the young plants are exposed to the night frosts, from which, however, they could be protected by the so-called hotbeds. Then again, if one succeeds in raising seedlings under these conditions, they should be ready for transplanting, say, two months after sowing, and this means that the seedlings are transplanted at an unsuitable time, first on account of having no rains during July, August, and September; and secondly, on account of night frosts during these months. Flooding tobacco

beds, instead of watering, is also very harmful, as the required amount of water cannot be well controlled in the seed bed; it is the principal cause of the loss of the plants in the seed bed, and even if they survive, they are more easily affected by disease, and later, in the field.

On most farms seed beds have been made below the level of the surrounding ground, so that water was actually led on to the beds. Although this may assist germination, the final result is very harmful. Often it will be seen that in the centre of these seed beds the seedlings have all died off. The plants have been practically drowned, and the seed has been sown too thickly. But on the edges of the bed where the seedlings managed to obtain sufficient space, air, and light, and were not affected by excess of water on account of the ground being slightly higher, they did well.

By this system the area of available land is not utilised to the best advantage, and much valuable seed is wasted, which is a serious matter, for the production of very good seed of selected plants is difficult.

It often happens also that the whole of the seedlings in the beds are destroyed by mildew or damp-off fungus and other diseases or insect pests. Another disadvantage is that the seedlings become long-stemmed and possess badly developed root systems which cause weak plants unable to stand the shock of transplanting and which are much more liable to disease than strong seedlings.

MODERN METHODS.

Selecting the Site.—Choose a spot sheltered as far as possible from cold winds. Winds dry out the seed beds, making it difficult to keep the soil moist enough for germination and growth. If there are no walls or houses for protection, it is advisable to provide hedges for this purpose.

The best soil is a rich sandy loam containing a rather larger percentage of sand and humus. A well-worked garden soil is the most suitable, but if only new land is available the latter should first be well worked. A heavy and clayish soil should be avoided, for it checks the development of rootlets and makes it difficult to pull out the seedlings at the time of transplanting.

On account of the great care tobacco seed beds need, it is advisable to choose a spot as near as possible to the planter's house, so that due care can be given to them both day and night. Another point is that the soil must be well drained, and at the same time a supply of clear clean water must be handy so as not to lose too much time carrying water to the beds. It is often advisable to have the seed beds on two different spots, so that in case one lot of beds is destroyed by disease, the other set is then at a safe distance from the affected ones. Good judgment must of course be used.

Laying out the Beds.—The next thing to do is to lay out, or mark off, the beds. Experience has proved that beds of three feet wide (inside measurement) are the best to handle. The workers can then easily reach all parts of the bed from either side of it. The beds can be of any length desired.

It is absolutely necessary that the beds should be quite level, and this is a point upon which the length of the bed might depend. In order to economise space, the distance between beds should not be more than absolutely necessary, but there must be sufficient space to allow a passage between the beds for working, and it has been found that a distance of two feet is quite sufficient for this purpose. In this case the actual passage, after the frames have been put up, will be about 18 inches, and this distance will be found quite convenient.

Preparation of Soil.—The preparation of the soil must next be taken in hand. If new ground is to be used, the first working of this soil ought to take place at least three months before sowing; better still about six months or even a year. In that case the laying out of the beds should be done after the soil has been worked up. The final preparation of the seed bed soil should take place after the beds have been laid out, or even after the frames have been put up.

In districts where there is frost during July and August, so-called *hotbeds* should be prepared if the planter wishes to obtain transplanting material in October and the beginning of November. For the latter transplanting season this is quite unnecessary, nor is it necessary in the low veld where there is no frost. As the preparation of hotbeds is done after the frames have been put up, the preparation of the ordinary beds is discussed first.

The soil of the beds must be thoroughly mixed with well-rotted stable manure. This stable manure should not consist solely of horse or mule manure, as these have the drawback of fermenting very rapidly, especially when a little fresh. If some cow manure is added and mixed, it has the advantage of decreasing the production of mushrooms, which other-

wise develop largely on beds exclusively manured with horse and mule manure.

The manure should always contain a sufficient quantity of straw, and after it has been well mixed with the soil the beds should remain untouched for a month or more. During the cold months, and from time to time (say once a fortnight) it should be worked to expose the soil to air and sun, and so kill any disease germs that might be present.

If hotbeds are necessary the top soil should be removed to a depth of, say, 10 inches and a layer of about 6 inches of fresh stable manure placed at the bottom. The soil taken out should be mixed with well-rooted stable manure, leaf mould, or any other well decomposed vegetable matter, and then be replaced on top and further treated as ordinary beds.

Frames.—Frames should be made so as to cover the beds in order to protect them against cold at night and sunshine in the day time, and to keep out flying insects. These frames, however, are not necessary in the low veld or for late beds at the higher altitudes, and these beds should only be protected against excess of sunshine and flying insects by means of grass-mats or cheese-cloth or muslin-cloth.

When frames are to be used they can be made of tarred wooden planks of about 1 in. thick and 10 in. to 12 in. high. Corrugated iron, which is generally present on a farm, can also be used for the purpose in such a way that the frame is about 6 in. above the level of the beds, and so as to receive the cover consisting of grass or cloth, which then cannot touch the young plants. A cheap and good way of constructing these frames is to surround the bed with sundried or, better still, burnt bricks, if possible, which can be easily made on the farm.

Fertilising.—Tobacco seed being very small (about 300,000 to the ounce) the reserve material for the nourishment of the seedling is very soon exhausted, and the seedling is forced to feed itself much sooner from the soil than with most plants. Therefore seed beds must be made in such a way that the seedlings will easily find plenty of available food. If they should not be sufficiently rich in plant food, fertilisers must be added, in addition to the humus which has been previously added in some form, and which will keep the beds better provided with moisture.

If fertilisers must be used, I recommend for potash the application of wood ashes, containing, besides other useful elements, a certain percentage of potash; for nitrogen, sulphate of ammonia, because its nitrogen acts more slowly than in nitrate of soda, and therefore it is better suited for seed beds (dried blood, which contains about 12 per cent. nitrogen, will also be excellent for seed beds), and superphosphates for adding phosphoric acid. If the beds have not received any kraal manure or tobacco stems or stalks, a complete fertiliser, containing, say 10 per cent. of potash, 4 per cent. of nitrogen, and 10 per cent. of phosphoric acid, all in an available form, may be used. If, after the seedlings have grown up a doubt exist that there is not sufficient plant food available, a small amount of these fertilisers could be applied in a dilute solution at the time of watering the beds. The young plants often show lack of plant food by looking yellowish and not fresh green and healthy.

Pulverising.—The upper layer of two or three inches of soil must be well pulverised and all coarse organic matter should be removed. This can be done by sifting. If the proportion of clay appears to be too large, some pure sand may be mixed with the surface soil; the advantage of this will be that the beds are better drained, and at the same time they will not dry out and cake so quickly. The rootlets of the young seedlings will also penetrate the soil more easily.

Sterilising.—On our Experiment Stations at Rustenburg and Barberton, we had our seed beds sterilised in a way which gave excellent results, and can therefore be recommended to tobacco planters. This method is as follows:—After the soil has been properly prepared and is in readiness for receiving the seed, boil some water in old paraffin tins or any other utensils at hand, and pour the boiling water as quickly as possible on to the beds so as not to let the water cool off too much, and allow it to soak in to a depth of about six inches. Repeat the treatment once or twice on one or two consecutive days. Sow the seed after the beds have dried up a little. This method of treating seed beds has resulted in our experiencing no trouble from fungus diseases or insect pests notwithstanding the fact on some of the beds fresh stable manure had been used. The application of boiling water on the beds not only seems to practically sterilise the surface soil, destroying disease germs and insects that may be present, but also destroys the weed—seeds present, which would otherwise produce weeds and interfere with the growth of the young tobacco seedlings.

Our method of applying water on the beds is a cheaper and simpler method than steaming the beds and far better than the method of burning them, adopted in some parts of America.*

* In America it is the general custom to burn the soil of the seed-beds by burning grass and logs on top, previous to sowing. The object seems to be to destroy the weed seeds, which are mainly present in the upper two inches of the soil, and which are killed off by burning or heating the bed. Another advantage is that by burning, certain mineral-plant-food, as for instance potash salts, is made more available for use by the plant. But the important *organic matter* or humus is largely destroyed by burning, which liberate the nitrogen, reducing the amount available for plant-food, and the destruction of the humus largely reduces the moisture-retaining capacity of the soil, which is a most important drawback with our climatic conditions in South Africa. Scarcity of wood for burning has lead to the invention of a tobacco-bed burner, which is a movable device especially designed for burning seed-beds. *It is thought, however, that for our South African conditions burning is not advisable.*

Methods have also been devised to steam the soil of seed-beds. Mr. Ingle, late Chief Chemist of this Department devised and described such a method in a previous number of this *Journal.* Mr. A. D. Shamel of the United States Department of Agriculture has also devised a method which seems to be in practical and successful use in Connecticut, and which is described as follows:—"A steam-pan is made of sheet-iron 10 feet long, 6 feet wide and 6 inches deep. Attachments are made which provide for the introduction of steam into this pan for the connection of the steam hose or pipe running from the steam boiler to the pan. This steam hose should be at least 1 inch in diameter and 50 feet long, so as to permit the supply of an abundance of steam and in order that the box may be moved without moving the steam boiler. The soil of the seed-bed is fertilized and prepared in the same manner as for the sowing of the seed. The pan is turned over a section of this prepared soil, and care is taken that the edges of the pan sink into the loose soil, so as to prevent the issue of steam from beneath the edges of the pan. The steam is now turned into the pan, and being confined under the pan, under pressure it rapidly heats the soil to the desired depth. A strong pressure should be maintained on the steam boiler and a full supply turned into the pan. In the beginning the temperature of the heated soil should be raised to 175° F. to a depth of at least four inches, and this temperature should be maintained for about one hour. This treatment destroys weed, seeds and disease-germs in the soil, and improves the condition of seed-bed soil for the growth of tobacco seedlings. About 600 square feet of the bed surface can be treated in one day by this plan. The tobacco seed should be sowed the following day and lightly raked in."

This method appears to be quite effective, but it may prove too elaborate and too expensive for our farmers

Quality and Quantity of Seed.– One ounce of tobacco seeds contains from 300,000 to 400,000 seeds, but owing to the smallness of the seed and the fact that a considerable percentage of it may not be good, 30,000 to 40,000 is considered a good average yield of seedlings from one ounce of seed. Even on this basis it is the custom of tobacco growers in oversea countries to sow about three times the amount that will actually be required to plant on a given area.

In the Transvaal most of the tobacco planters do not measure the quantity of seed to be used for a certain area and consequently sow too thickly, which causes a great deal of loss through disease and even then produces only weak seedlings. During our experments in our tobacco stations we have found that to obtain more good and healthy seedlings from one ounce of seed, at least one hundred square yards of beds are required. This is partly due, first to our only sowing well-matured and selected seed, of which the quality is far better and the germination power much greater; secondly, to our beds being well prepared. It must always be remembered that in order to raise good, strong, and healthy seedlings *it is much better to sow too little than too much seed.*

Seed.—On account of the care and expense that have been devoted making and preparing the seed beds the importance of using only well-bred, thoroughly cleaned seed which is tested for germination, will be evident. For the main crop only seed should be used of plants which are grown on the farm, and these should be especially selected plants. The seed should be selected from bagged plants of the finest type, from the main terminal flower-cluster, from the largest and strongest capsules (seed pods) after having taken off the smaller and weaker ones, having only about sixty capsules to the crown stalk, and finally the heaviest seed must be separated and the light seed be discarded. A full description of how to select plants for seed production will be found in *Farmers' Bulletin*, No. 28, which is issued to tobacco planters free of cost on application to the Government Printer.

If newly introduced seed is to be used it should only be done on a small scale; from these plants enough seed can be saved of varieties or types which prove successful and which produce a good marketable leaf.

Seed for the main crop should have good vitality, a condition which can be easily tested by placing one hundred seeds between two moist blotters, keeping them moist between two plates for

a sufficient length of time to allow the seed to germinate. The percentage of seeds that have germinated in a certain number of days (six to ten days) can then be noted.

Separating Seed.—It is a well-known fact that the use of poor seed is largely the cause of the lack of uniformity in tobacco fields. Before sowing, seed should be separated so as to remove the light and immature seeds. A very simple way to do this is to pour the required amount of seed into a glass of water and allow it to stand for a while; a part of it will sink to the bottom and the other part will remain on the surface. After removing the seeds from the surface, and having emptied the glass, the sunk seed on the bottom should be collected and spread on a piece of paper in order to dry.

Another method of separating the heavy and light seed is by means of a tobacco seed grader, which consists of a glass tube connected to a foot bellows by a rubber tube. About one ounce of seed is placed in the glass tube connected to a foot glass tube and a current of air is injected by means of the foot bellows. The strength of this current must be regulated by a valve, so that only the dirt and light seeds will be blown out of the top of the tube. It is advisable to screen out all the large particles of hulls and trash before putting the seed in the tube. One of these tobacco seed graders has been constructed in our office, and is gladly placed at the disposal of tobacco planters who wish us to separate their seed for them. In the near future specimens of these graders will be placed in different districts for the use of planters.

Soaking Seed.—To provide a quicker germination it is often advisable before sowing to soak the seed in water for about twenty-four hours. This will soften the seed coat and quicken germination.

Mixing of Seed.—If such small seed were simply to be sown broadcast over the bed, it would be impossible to obtain uniformity with regard to the distance between the seedlings; and as has been seen, it is most important that the seeds should be sown rather thinly so as to give each seedling at least a square inch of soil for development. It is therefore recommended to take the required amount of seed weighed off for a given area of seed bed and mix it thoroughly with about one hundred times its weight of fine ashes, fine dry earth, or mealie meal. Mealie meal is probably the best on account of its white colour, as the spots where the seed has fallen can be better controlled; it is also useful for its fertilising properties.

Sowing Seed.—The required amount of seed being thoroughly mixed, say one ounce of seed with 100 ounces of mealie meal, which amount is required for 100 square yards, it would be best to divide this mixture of seed and mealie meal into ten parts, and sow one-tenth part as uniformly as possible on ten square yards. If the whole amount has been sown at one time it will be found more difficult to obtain the required uniformity. Be careful to see that the bed is uniformly covered, thus ensuring the uniform distribution of the seed.

After sowing, the seed should be lightly pressed into the soil with a light roller, or by slightly pressing the earth down with wooden plank. A little pure sand should be spread over the beds to prevent the caking of the top soil and to keep moisture better within reach of the seed.

Watering.—The bed should be watered at this stage. The water must be gently applied with a watering can, having a very fine nozzle to prevent the seeds or young seedlings from being washed out of the soil. As explained before, water should not be led over the beds.

If the beds are shaded, watering may be infrequent, but if not shaded the surface of the bed requires frequent slight watering to keep the tiny seeds from drying out before the plants are well rooted. The surface of the soil should never be allowed to become dry. Frequent drying will weaken or totally destroy either seed or plants. As the plants increase in size the watering should become less frequent and more thorough, and it is then beneficial for the surface of the soil to become dry occasionally. When the plants begin to cover the ground a larger nozzle may be used, and the aim should now be to keep the soil moist and the plants dry, *i.e.*, when thoroughly watered the plants, being exposed to the sun, will dry off quickly and the soil being shaded by the plants will remain moist. Wet plants and an atmosphere surcharged with moisture induce the development of "damping-off" fungus and other diseases. In the Transvaal, with its dry and sunny weather during the growth of the seedlings, there is little danger if water is applied by means of a watering can as described.

Shading.—The beds must be kept covered with grass or reed-mats at night so as to keep them warm, and also during the daytime in order to keep

the beds dark, as this will facilitate germination. The cover should be lifted at times for ventilation purposes. After the seed has come up the same covering can be used at night during the winter months. During the daytime more light should be admitted, although care must be taken to prevent the hot sun burning the plants; therefore, in addition these grass or reed-mats, cheese cloth or muslin cloth must be used so as to cover the whole bed and to prevent flying insects depositing their eggs on the young plants, as was the case with the splitworm which last season destroyed a large number of beds and plants on the fields of neighbouring farms.

Although at first the seedlings must be protected from the hot sun during the day by means of shade covers, they will soon become stronger and healthier; they must then be allowed sufficient light, air, and moisture, by gradually taking off the shade. The shade afforded must be made less as the seedlings grow, so as to harden the plants and prevent their becoming weak and long-stemmed, and thereby less able to stand the shock of transplanting and to resist disease.

Remedy for Disease and Insects.—Even if the beds are sterilised it is still advisable to spray them with Bordeaux mixture as a preventive of fungus diseases. The preparation of Bordeaux mixture has already been described in *Farmers' Bulletin*, No. 27.

For seed beds the proportion should be at the rate of fifty gallons of water, three pounds copper sulphate, and two pounds unslaked lime. This spraying could take place after the seed has come up, say once every fortnight.

For insect pests an application of Paris green mixture could be given at the rate of one pound of Paris green and two pounds of lime to two hundred gallons of water. To prepare this mixture, take the required amount of water and stir in the necessary amount of Paris green. Then stir in the lime, which has previously been slaked with water in another vessel. Thoroughly stir the whole and apply with a spray pump.

A greater number of beds are yearly lost through white rust or mildew. If this appears in the beds it is easy to save the seedlings by dusting the foliage with sulphur mixed with one-sixth its quantity of quicklime, which will check the disease. This has been tried on Government tobacco farms and gave splendid results.

Weeding.—When moistening the beds a great number of weeds are likely to appear; these should be pulled out as soon as possible so as to assure the young seedlings a normal development Weeds utilise the available plant food. to the detriment of the tobacco seedlings.

Thinning.—If on some parts of the beds the seedlings come up too thickly they will not get sufficient air, light, and space to develop. The bed must therefore be thinned out. If this is not done there is a great danger of disease making its appearance, and even seedlings which survive will become tender and long-stemmed with an undevelpoed root system, which is very undesirable.

Size of Seedlings.—The best seedlings for transplanting are those three to four inches in height, having from six to eight leaves. If transplanted when larger it would be found, as there is larger surface for evaporation there is greater risk of dying off, for the rootlets will require a day or two, or sometimes longer, before properly taking hold of the soil. Dead plants can, and must of course, be replaced by fresh seedlings, but this prevents uniformity and maturity, and the planter must therefore do all in his power to avoid losing plants when set out in the field.

In order to save time and trouble afterwards, the best plan to adopt is to remove and destroy the weak and bad seedlings from the beds at an early date, *i.e.*, those which are yellowish-looking and long-stemmed, also those damaged by insects or diease. If, however, proper care is bestowed upon the seed beds most of the young seedlings will be found to be healthy, and good transplanting material, better able to stand the shock of transplanting, will be available.

Pulling out Seedlings.—To facilitate the pulling of the young seedlings and to decrease the risk of damaging the leaves, and more especially the rootlets, the seed bed should be thoroughly soaked with water before this work is commenced.

If the seed has been thinly and evenly sown it will be found that the pulling out can the more easily be done. I do not recommend that all the earth should be shaken and washed off from the roots of the seedlings, as is sometimes advised, for by the latter method the risk of damaging the rootlets is increased, whereas, by adopting the former method the seedlings will take root more easily and quickly when set out in the field.

When taking seedlings from the bed use a pointed stick, and by running this under the rootlets and then giving it a twisting motion, the soil around the plant is loosened, and by taking the latter by the tips of the top leaves it can

be lifted from the soil with most of its roots intact. Do not take hold of a seedling by the growing bud, for by so doing you will bruise it.

Transplanting Seedlings to field.—Pack the seedlings carefully in a shallow basket provided with a handle, and keep it covered so that the young plants are protected from the air and sun. If the field is close at hand do not lift too many at the same time. A little loose damp earth, sprinkled amongst the roots of the plants and to slightly moisten and cover the tops, enable the seedlings to withstand the exposure entailed by a longer journey. If this is done the plants can be transported some considerable distance, provided they have been properly packed. Good results may be obtained, even if they are not set out until the following day. This is, however, not to be recommended unless absolutely necessary.

CAMPHOR.

PRELIMINARY NOTES ON THE PREPARATION OF CAMPHOR IN THE F. M. S.

(From the *Agricultural Bulletin of the Straits and F. M. S.*, Vol. VIII., No. 8, August, 1909.)

In view of the forthcoming Agricultural Show at Penang in August, the following notes on investigations which are now being carried on in the preparation of Camphor from the common Formosan or Japanese Camphor tree together with notes on the cultivation and growth of the plant in Malay Peninsula have been published, since it is hoped that an exhibit of this product among others prepared by the Agricultural Department of the F. M. S. will be on view at the Show and may be of interest to planters.

Considerable attention has been attracted to this product during recent years owing to the Japanese monopoly, indeed, to such an extent that the synthetic product has already been placed on the market at home and in Europe to compete with the natural product, and this has been due to the prevailing high prices of the natural Camphor owing to the monopoly by Japan. The synthetic product, however, has been (for the time at any rate) short lived, as owing to a fall in the price of the natural product it was soon unable to compete successfully with natural camphor. It must, however, still be borne in mind that cheaper sources of raw material may eventually be found from which to prepare the synthetic compound, than oil of turpentine, which is the present raw material, and which on account of its great demand for other purposes is very costly. This monopoly by the Japanese Government has had another effect, for it has directed the attention of planters and tropical agriculturists in the various colonies of the Empire and in other countries, *e.g*, Ceylon, Hawaii, Southern India, and California to the cultivation of the plant, and considerable interest has been taken in it recently in the Malay Peninsula.

The value of the camphor industry to the Japanese is thoroughly recognised by their Government, and the wholesale destruction of camphor trees in Formosa and other places is now being compensated for by a vigorous planting scheme. It is interesting to note that between 1900 and 1906 some 3,000,000 trees were planted and arrangements have been made for the planting of some 750,000 in each successive year.

It will thus be seen that the Japanese are fully alive to their interests in this matter, and the tropical planter must not look too much for that shortage of supply, due to the destruction and non-renewal of the trees, which many thought would come sooner or later.

SUPPLY.

The World's consumption of camphor in 1907 was estimated at 10,600,000 pounds, (figures for 1908 are not available), about 70 per cent. of which was used in the manufacture of celluliod, 15 per cent. in the preparation of disinfectants; 13 per cent. in medicinal and pharmaceutical preparations, and the remaining 2 per cent. in the manufacture of explosives.

To this amount Formosa contributed 5,388,918 lbs., the remainder came from other Japanese Islands and from China.

The camphor industry is one that can of course never be put on the same footing as rubber in Malaya, but considering the free growth of camphor trees in this country, it would form a very suitable subsidiary industry especially as a very fair return may be expected in the third year.

It would probably scarcely pay to plant less than 50 acres, while larger areas up to a reasonable limit would pay better.

BOTANY AND HABITAT.

The common Japanese or Formosa camphor *Cinnamomum Camphora*, Nees, also known as *Camphora officinalis* or *Laurus Camphora*, is an evergreen tree belonging to the Natural Order *Laurineæ*. It is found along the Eastern Coast of Asia from Cochin China to

Shanghai, in the Island of Hainan and in the Japanese Islands Kinshu and Shikoku, largely abounding in Formosa, the head quarters of the industry. The products, chiefly camphor and camphor oil, are obtained by distillation, details of which are given below.

CULTIVATION IN MALAYA.

The following notes on the cultivation of the plant in the Government Experimental Plantation, in Selangor, the preparation of the crude and purified camphor and camphor oil are intended only as a preliminary note, as it is hoped to prepare an article on the subject when the investigation is more complete.

The first experiments in camphor by the F. M. S. Agricultural Department were initiated in Batu Tiga five years ago by Mr. Stanley Arden.

The seeds of the Batu Tiga trees were obtained from the Yokohama Nursery Company and sown in May, 1904.

They were planted out in their permanent quarters 10′ × 10′ in December of the same year. The growth as a whole is very good, while the growth in some cases is exceptional. The average height of the trees is now about 18 feet, the tallest tree being over 26 feet.

A further supply of seeds and young plants was received from Japan in May, 1907, and planted out in the Experiment Plantation, Kuala Lumpur, in September of the same year.

The growth of the plants in this case has also been good, the trees averaging in one plot 5 ft. 6 inches in height and 4 ft. 6 inches in breadth; this plot was cut over, bringing all the trees to one even height of 5 ft., and leaving the sides untouched and yielded a crop of clippings averaging 1,226 lbs. per acre; the actual yield of camphor from which amounted to 0·6 per cent.

PREPARATION OF CAMPHOR.

Method of distillation :—

The first experiments were made on a very small scale in a small copper still of 7 litres (= 12·3 pints) capacity and capable of holding only about 1½ lbs. of leaves or about 4 lbs. of twigs, using an ordinary glass Liebig condenser to condense the camphor and oil.

Steam was generated in a separate boiler and passed through the leaves or twigs in the still.

PREPARATION OF MATERIAL.

Experiments were made with material prepared in the following manner (1) the unbroken leaves, (2) leaves cut up into small pieces, (3) air dried leaves, (4) mouldy leaves, (5) twigs cut up into small pieces about an inch long. The leaves and twigs used in these experiments were cut by coolies using parangs (knives) only.

On a commercial scale some kind of chaff cutting or other similar machine could be used for the purpose, to save labour, either worked by hand, by bullocks, or machine driven as circumstances necessitate.

PRELIMINARY EXPERIMENTS.

11·5 kilograms = 26 lbs. of prunings consisting of 64·9 per cent. leaves and 35·1 per cent. twigs were received for experiment from the Superintendent of Experimental Plantations (Mr. J. W. Campbell) being the part prunings from a five year old tree at the Experimental Garden, Batu Tiga, Selangor.

As only the small apparatus (described above) was at the time available for the experiment, the distillation had to be extended over a number of days, and the results of each distillation were kept separate for comparison and carried on under different conditions as described above, entirely for experimental purposes, in order to ascertain if these conditions gave different results.

The following results were obtained:—

(1) 1st distillation. 400 grams of cut leaves gave 4·89 grams of camphor and camphor oil = 1·22 per cent.

This consisted of camphor 1·16 per cent. and oil 0·06 per cent.

(2) 2nd distillation. 500 grams of leaves more finely cut than in (1) gave 5·86 grams of camphor and oil = 1·17 per cent.

This also consisted mainly of pure camphor.

(3) 3rd distillation. 1,500 grams of twigs gave 6·75 grams of camphor and oil = 0·45 per cent.

This also consisted chiefly of camphor.

(4) 4th distillation. 500 grams of leaves and twigs gave 6·25 grams of camphor and oil = 1·25 per cent.

(5) 5th distillation. 1,000 grams of twigs gave 0·6 grams of camphor and oil = 0·60 per cent.

(6) 6th distillation. 500 grams of leaves (mouldy) gave 6·26 grams of camphor and oil = 1·25 per cent.

(7) 7th distillation. 500 grams of leaves previously dried in the sun for two or three days, gave 6·27 grams, (weight of dried leaves = 300 grams) camphor and oil = 1·25 per cent. Calculated on air dried leaves = 2·09 per cent.

(8) 8th distillation. 500 grams of leaves (mouldy) gave 7·35 grams camphor and oil=1·47 per cent.

(9) 9th distillation. 750 grams of leaves and twigs previously air dried. (Final weight=4·68 grams) gave 8·27 grams of camphor and oil=1·10 per cent. Calculated on air dried material=1·77 per cent.

(10) 10th distillation. 500 grams of leaves air dried, (Final weight=·210 grams) gave 5·83 grams camphor and oil=1·16 per cent. Calculated on air dried material=2·4 per cent.

(11) 11th distillation. 500 grams of mouldy leaves, air dried, (Final weight= ·270 grams) gave 7·71 grams camphor and oil=1·54 per cent. Calculated on air dried material=2·8 per cent.

(12) 12th distillation. 500 grams of whole leaves air dried, (Final weight=·285 grams) gave 7·53 grams camphor and oil=1·50 per cent. Calculated on air dried material=2·6 per cent.

(13) 13th distillation. 500 grams of leaves and twigs, etc., gave 7·92 grams of camphor and oil=1·58 per cent.

Conclusions.—These experiments show (1) that a much larger percentage of camphor and oil is obtained from the leaves than from the young wood or twigs.

(2) That air drying has no detriminal effect on the yield:—if air drying be rescrted to. however, it should not be carried out in direct sunlight.

(3) That the principal product is camphor with a small percentage of oil.

(4) That a yield of at least 1 per cent. of camphor with a small percentage of oil may be expected from the prunings of trees of this age, viz., 5 years, and probably from trees younger than this.

FURTHER EXPERIMENTS ON A LARGER SCALE.

As the above preliminary experiments appeared to be so satisfactory it was decided to erect a large still on a more practical scale.

A plant was constructed on our design by the Federated Engineering Company, Kuala Lumpur, and although satisfactory, experience has shewn that it can be improved in many ways.

Description of large Still and Condenser :—

(1) *Boiler*.—On many Estates where rubber and other produce is grown the question of steam has already been settled, and there would be no necessity for another boiler. For experimental purposes, however, a small boiler had to be erected. This consisted of a simple cylindrical boiler which was erected horizontally on a simple brick and cement foundation and was fired externally by wood. The boiler is fitted with a water level, and safety valve, together with an opening for filling at the top.

(2) *Still*.—A pipe from the boiler conducted the steam below a perforated plate in a plain cylindrical still, the leaves, wood, etc., to be distilled, being placed on the top of the perforated plate, the still being charged from the top. The top of the still was fixed by means of nuts and screws and rendered air tight by asbestos rings.

(3) *The Condenser*.—The condenser was a kind of quadruple Liebig condenser, consisting of a vertical cylinder containing four copper tubes connected above and below with an air space. The tubes were surrounded with the cooling water which was led in by means of a pipe over the bottom and flowed away near the top. The bottom and top of the condenser were fixed by means of nuts and screws and rendered air tight by asbestos and were detachable for cleansing purposes. A short bent copper tube from the bottom air space carried off the condensed steam, camphor, and oil, which was collected in glass vessels.

The boiler, still, and the outer shell of the condenser were constructed of iron, the tubes of the condenser and upper and lower plates attached to these tubes were of copper. The following are the dimensions of the above apparatus and the capacity of the still in terms of fresh camphor leaves, prunings, and wood (the latter cut up into small pieces):—

Boiler.	Length 2 feet 9 inches.
	Diameter 1 foot 9 inches.
Still.	Length 2 feet 6 inches.
	Diameter 1 foot 9 inches.
	Capacity in terms of camphor leaves 30 lbs.
	Capacity in terms of camphor wood 90 lbs.
	Capacity in terms of prunings 50 lbs.
Condenser.	Length 2 feet.
	Diameter 9 inches.
	Length of copper condensing tubes 1 ft. 9 in.
	Diameter of copper condensing tubes 1 inch.

Criticisms of apparatus : (1) The chief disadvantage of a metal (iron) condenser is the discolouration of the camphor by iron rust. If the condenser were entirely of copper there would be little or no colouration.

(2) Since practically all the camphor condenses in the condenser tubes and

only the oil and water pass into the receiver, a tube condenser has the disadvantage that the tubes would soon get blocked. Apart from this the layer of camphor on the tube would form a non-conducting medium and lessen the efficiency of the condenser.

(3) It is difficult to clean out a tube condenser, and easily remove the camphor, though this could easily be done by a special scraper fitting the condenser tubes.

(4) The chief disadvantage of the particular still described is the time wasted in discharging and recharging.

The discharging could be hastened by having a lateral opening above the perforated plate, and made air tight by an asbestos sheet.

(5) In a large still the weight of the leaves or wood, especially when wet, would tend to create pressure inside, by blocking the passage of steam. This could be remedied by using a series of perforated plates, a definite quantity of material (wood or leaves) resting on each.

A better plan and one which would simplify discharging and charging would perhaps be a metal cage which could be lifted bodily out of the still by means of a crane or other mechanical device and easily emptied by inversion and replaced when discharged. This would also allow steam to enter the material from all sides.

YIELDS.

In the first experiment with this apparatus, a whole tree, including roots, was received from the Batu Tiga Experimental Plantations and consisted of :—

Leaves weighing 12½ lbs. = 7·5 per cent.

Twigs less than ½ inch diameter weighing 30 lbs. = 18·2 per cent.

Twigs and wood over ½ inch diameter 93 lbs. = 56·3 per cent.

Roots 29·5 lbs. = 18·0.

Separate distillations were made of the leaves, twigs under ½ inch diameter, wood, and root with the following results :—

12½ lbs. of leaves yielded 2 ozs. of camphor and oil = 1·0 per cent.

30 lbs. of small twigs yielded 1·07 ozs. of camphor = 0·22 per cent.

93 lbs. of large twigs and wood yielded 9·8 ozs. of camphor = 0·66 per cent.

29½ lbs. of Roots yielded 5·7 ozs. of camphor and oil = 1·2 per cent.

The camphor in these experiments was of a brownish colour, due to contamination with iron oxide or rust from the condenser.

Most of the camphor scraped from the copper tubes of the condenser was almost white, which leads to the conclusion that a copper condenser would not discolour the product. The discoloured camphor can readily be rendered white by redistillation through a glass condenser or by sublimation.

PERIODS OF DISTILLATION.

In the small preliminary experiments it was found that all the camphor and oil distilled over within three hours or rather less, in fact the greater portion of the camphor distilled over within half an hour after steam commenced to pass throuuh the material. In the later experiments the distillation was carried on for a longer period than three hours in order to ascertain whether in the larger plant, similar results would be obtained. In each case the camphor and oil from three hour distillations were collected separately and the following results obtained :—

(1) Distillation of leaves.

First period of three hours. Camphor and oil obtained = 1·0 per cent.

Second period of three hours. Trace only.

Third period of three hours. Nil.

(2) Distillation of twigs.

First period of three hours. Camphor and oil = 0·20 per cent,

Second period of three hours. Camphor and oil = 0·022 per cent.

Third period of three hours. Nil.

(3) Distillation of wood.

First period of three hours. Camphor and oil obtained = 0·56 per cent.

Second period of three hours. Camphor and oil = 0·075.

Third period of three hours. Camphor and oil = 0·022.

(4) Distillation of roots.

First period of three hours. Camphor and oil = 1·0 per cent.

Second period of three hours. Camphor and oil = 0·2 per cent.

Third period of three hours. Camphor and oil = Trace.

Conclusions.—These experiments indicate that it would probably not be advisable to carry on the distillation for a longer period than three hours in the case of camphor prunings.

Photo by H. F. Macmillan.

FLACOURTIA INERMIS.

"Lovi-Lovi."

Comparison with Previous Investigations.

The results compare favourably with the investigations of Messrs. Willis and Bamber on the cultivation and preparation of camphor in Ceylon (*Vide* Circular Series I, No. 4, Royal Botanic Gardens, Ceylon, 1901). Hooper (*Vide* Pharmaceutical Journal (56) Vol. ii. P. 21) also obtained a yield of 1 per cent. of oil from leaves of plants grown in India. In one instance the oil is stated to contain only 10-15 per cent. of camphor, while another specimen yielded 75 per cent. of camphor.

Schimmel & Co., in Germany, one of the largest manufacturers of essential-oils, also obtained an oil from the roots, which was stated to consist chiefly of camphor. The amount of camphor isolated from the oil will depend on temperature, etc., more camphor can be separated from the oil by cooling, and also by redistilling the oil alone, preferably under reduced pressure, or with steam.

The camphor is a much more valuable commercial article than the oil, but the oil is also used to a considerable extent now for the preparation of safrol, as well as for solvent purposes, in cheap perfumery, soaps, etc.

Future Experiments.

The experiments already initiated will be carried on as time permits with further material and with younger trees. The trees in the Experimental Plantation, Kuala Lumpur, are only two years old, and experiments will be made with these at intervals, to ascertain the yields at different stages of the plant's growth. Experiments are also being made to find the most suitable planting distances, and in addition, the most suitable form of cultivation, methods of pruning and their effects are being investigated.

Analyses of the soils on which these trees are being cultivated will also be made, and the manurial value of the prunings estimated before and after extraction.

Borneo Camphor.

Investigations are also being carried on with *Dryobalanops Camphora* of the Natural Order *Dipterocarpeæ*, commonly known as the Borneo or Sumatra camphor tree, from which the valuable so called Borneo Camphor is obtained.

This tree does not yield the true "camphor" known in commerce, but a closely related compound known as Borneol.

The oil and "camphor" has not hitherto been an article of commerce at home, but is chiefly used by the various Eastern nations for ritualistic purposes and for embalming. No very detailed chemical examination of the oil has so far been carried out, owing to the scarcity of the oil. The oil has been obtained previously by distillation of the wood (age?) and, by tapping the trunks.

The crystals of "camphor" can often be seen in cavities in the wood.

According to Watts' "Commercial Products of India," 1908, this camphor is that of ordinary camphor. An average tree (age ?) is said to yield 11 lbs., the older trees being the most valuable, while only some 10 per cent. of the trees destroyed are really remunerative.

Experiments are being carried on at present with the prunings from trees nine years old cultivated in the Experimental Plantation, Kuala Lumpur.

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EDIBLE PRODUCTS.

THE INDIAN TEA INDUSTRY.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 4, April, 1909.)

Recently the manuring of tea has taken its place, on the majority of gardens, in the ordinary routine work, and practically all estates now keep careful records of the quantity of manure applied and the outturn of the different plots under treatment. Still, it must be admitted that the manuring of the tea plant in India is in its infancy. But though progress is slow there are indications that manuring is to be of great importance in the near future.

For several years the value of soil analysis was greatly overrated; now the pendulum has taken a swing the other way, and at the present day there appears to be a tendency to underrate its utility. Some time ago a book was published in Germany assuming that by studying plant and soil analyses one would be enabled to supply different plants with ideal manures, but results

in practice proved that the deficiencies of the soil could not be supplied by laboratory experiments alone. Soil analyses, chemical and mechanical, and analyses of the tea plant undoubtedly help in providing the planter with a knowledge of the bush's requirements, but the only true results are to be obtained from actual field experiments.

All good tea soils contain a vast quantity of potential plant-food which by careful tilling can be converted into available plant-food. Fertilisers are unnecessary on newly opened out land, but after a few years the soil refuses to yield good crops by cultivation alone, so we are compelled, if we are to keep up our outturn, to supplement the store of available food.

The planter, by careful cultivation, economises the natural store of plant-food, but it is also good planting practice to judiciously supplement the easily exhausted constituents of the soil. Unless the bushes are kept up by artificial restoration, the yield must gradually diminish and the production sink to a low ebb. When the soil gets partially exhausted the annual quantity of presently assimilated food is insufficient, even under the best cultivation, to produce a maximum crop of good quality.

THE DOCTRINE OF ECONOMY.

No fertilisers should be imported until all available manure about the estate is used up, and it must always be borne in mind that many manures may be purchased at too great a cost; therefore, experiments must be carried out and discretion used when introducing new manures. There is a sad waste of cattle manure on many estates, through neglect of ordinary precautions, but the planter is now beginning to realise the great gain through the use of roofed pits, and by covering manure with layers of soil or succulent jungle when this is procurable. Serviceable pits do not cost much to make, and should be roofed with thatch or corrugated iron; old coolies, who are unable to perform ordinary tasks, are often available for the work of collecting. Manure should be daily collected and pitted to avoid waste of the most valuable ingredients.

Dr. Dyer, writing on the subject of "Manure Preservation," says:—"Other methods of preservation described, less simple, but nevertheless easy to carry out, are to sprinkle the dung, as it is produced, with materials which, like superphosphate and gypsum, shall act as fixers or absorbants of ammonia; or which, like kainit, shall act as antiseptics, or preservers of the dung from speedy fermentation. The former produces a fairly ripened manure suited to clay soils poor in humus or organic matter; while the latter are recommended for the preservation of dung for light and open land, on which it is desirable that it shall be applied 'long' or unrotted. If the former method of chemical treatment be adopted, a mixture should be made of equal parts of superphosphate and gypsum, and about 1½ lb. or 2 lb. a day, per head of stock, should be sprinkled amongst the dung. If, on the other hand, kainit be used as an antiseptic., about 2 lb. per head per day should be strewn on it. The immense superiority of manure prepared in either of these ways to manure heaped without these precautions has also been proved not only by analyses but by experiments in the field. It may be added that unless proper care is taken in the making and preserving of dung, the sooner it goes on to the land the better."

The use of heavy dressings (over eight tons per acre) of cattle manure to tea land, unless to benefit the soil mechanically, is not to be recommended, better results being obtained from the use of moderate dressings supplemented by concentrated fertilisers.

In otherwise good tea land, one of the three essentials—nitrogen, phosphoric acid, or potash—may be temporarily exhausted and thus render the soil incapable of carrying its maximum crop. If the planter by observation or experiment is able to recognise which form of plant-food is needed, he can by the use of the particular artificial manure force a good crop, provided, of course, that the soil is otherwise in good condition. It is not only necessary for the planter to know what manures to apply, but also the quantities and best time of application. In the writer's opinion the nitrogenous manures used in the Heeleaka experiments ought to be applied in smaller quantities at frequent intervals, but, as with our other tea problems, this can only be proved by a series of experiments. The best results so far obtained in tea manuring have been from the use of cattle manure, oilcakes, and sterilised animal meal, but as these cannot be had in sufficient quantities, we shall in time be compelled to go in more largely for mineral manures.

MINERAL MANURES.

Nitrate of soda and sulphate of ammonia are two of the most likely of the nitrogenous mineral manures to give beneficial results, but sulphate of ammonia is slower than nitrate of soda in

its action as it has to be converted into a nitrate before it is available to plants. It might be mentioned here that 66 parts of sulphate of ammonia are equivalent to 17 parts of ammonia and to 14 parts of nitrogen ; this is a point worth remembering, as nitrogen in a manure analysis is often expressed as ammonia.

Bones treated and untreated have been largely used on some estates, but the results have not been as good as one would anticipate from their analysis. Potash is a fertiliser that is seldom needed for heavy soils, but *bhils* and light soils are often in need of this constituent. Wood-ashes, some of which contain as much as 10 per cent. of potash, and 3 per cent. to 6 per cent. of phosphoric acid, are always valuable as potassic manures ; but they must be protected from rain. The cheapest potash fertiliser is kainit, but, on the whole, sulphate of potash appears to give better results on tea soils ; it usually costs more in proportion, but there is less bulk to carry and deal with.

Artificial manures are generally used because, in most cases, the food they contain is in a readily available form. Curiously enough the ready availability of concentrated artificial fertilisers is sometimes used as an argument against them, when compared with "lasting" manures. But as the plant-food in the manure represents so much capital, it is the object of the planter to realise the interest on his outlay as quickly as possible. A well chosen artificial manure should act decisively on the bushes and should show a balance on the right side. Success in planting in the future undoubtedly lies in the application of scientific methods, and the planter who would succeed beyond his fellows will do well to ascertain, by confirming facts for himself, by observation and experiment.

THEA.

RICE CULTIVATION IN LOW-LYING LAND IN BURMA.

BY KHAN BAHADUR MIRZA ABDUL HOSAIN,
Moulmein.

(From the *Agricultural Journal of India*, Vol. IV., Pt. III., July, 1909.)

There are extensive tracts of low land in Lower Burma which are lying waste owing to their being inundated during the latter portion of the rainy season in August and September. In some places the water rises four or five feet high. When the water subsides, sowing or transplanting cannot be done as the rains cease in the beginning of October; nor are these tracts fit for cold weather cultivation because such crops do not get the few necessary showers.

It appeared to me that the method of cultivation in vogue amongst Burmans was faulty, and that by altering the method it might be possible to combat the floods successfully.

The method practised by Burmese in this district is to begin ploughing after the rains have well set in and the land becomes soft. Sowing or transplanting is done generally in July. In August—the month of floods—the paddy plants are only about two feet high, and when submerged for a few days they perish.

It occurred to me that if the ploughing could be done in the dry weather, and the sowing before or immediately after the setting in of the rains, at least two months would be gained, and the plants might be tall enough in August to resist or survive the floods. But two difficulties were suggested against this change. First, that land could not be ploughed ; and, secondly, if the sowing were early, the crops would mature correspondingly earlier, *i.e.*, before the rainy season was over, and that, therefore, reaping and threshing would be practically impossible while the rainy season continued.

It became also clear to me that the country ploughs could not plough dry land, but it might be possible to overcome this difficulty by other appliances or improved ploughs; besides, if the plants got into ear correspondingly earlier, the continuance of the rains would retard their maturity and thus make the grain fuller and richer.

I accordingly decided to make an experiment. I imported a few English ploughs from Messrs. Ransomes, Sims, and Jefferies, of Ipswich, and began ploughing in January. For the first three or four days it was uphill work, and my men regarded the use of the ploughs as hopeless. After some perseverance the men learnt to handle them. These ploughs did good work when yoked each to two buffaloes. My men have since discarded country ploughs in favour of Ransomes' English ploughs both for dry and wet weather ploughing. The kinds marked E. C. and S. R. A. W. in Ransomes' catalogue are most in favour, though we use some of the smaller kinds for lighter work.

Having finished ploughing, I began sowing. For broadcasting the Burman soaks the seed two or three days to sprout. The practice, though alright when water is standing in the fields,

appeared to me to be open to two objections. In the first place, if by the time the seed has sprouted there should be a break in the rains, the sprouted seed cannot be held back, and if broadcasted would be liable to perish. In the second place, the sprouted seed is liable to be injured by handling. I therefore decided to try new methods—new at least to this district. The first was to broadcast dry seeds on dry land and then to give the land light ploughing to cover up the seeds.

The second was to raise the seedlings by irrigation before the rains commenced, and to transplant them immediately after the rains set in. Both these methods succeeded exceedingly well. By the month of August when water rose to five feet in the land the paddy plants were six feet high, and so were not submerged and survived the floods. Furthermore, the plants were reaped when ripe about the same time as the later sowing on other fields.

The kinds that grew best were *Yehini* and *Shangley*. The qualities of both were as superior as those grown on ordinary paddy lands. These experiments have been under successful trial for three years.

It has thus been demonstrated that in low-lying lands, where floods do not permit of good paddy being grown according to the ordinary methods, it can be grown successfully if cultivated earlier than usual.

Besides, there was an advantage in ploughing land during the dry season. A plot of land which in previous years when ploughed during the rains produced poor crops, was looked upon as poor land.

This area yielded excellent crops when ploughed in the dry weather. This proved the advantages of dry weather ploughing and exposing ploughed land to the sun.

This method of dry weather ploughing is being adopted by some of my neighbours, who now see that under certain circumstances a departure from old methods is conducive to improved cultivation.

For low-lying lands there is, of course, the water-resisting paddy known by the Burmese names of Todaungbo or Yemanaing, which for the last two years has been making headway in this district; but the grain does not find favour with the millers.

THE CULTIVATION OF THEOBROMA CACAO OR CACAO.

BY A. FAUCHERE,
Assistant Inspector of Agriculture in Madagascar.

(From the *Philippine Agricultural Review*, Vol, II., No. 6, June, 1909.)

THE ESTABLISHMENT OF THE PLANTATION.

A plantation may be started in two ways—by planting the seeds directly or by using plants already started in a nursery. Each of these methods has its partisans and its adversaries. It seems to me that these differences in opinion are due to the different conditions under which the observations were made. Thus, Guèrin, in his work, "Culture du Cacao à la Guadaloupe, " utterly condemns the using of nursery stock, while the planters of Surinam and Madagascar usually plant trees that have been six or eight months in a nursery.

It is very evident that in the cacao lands in Guadaloupe, usually formed of decomposed volcanic rock, it would be impossible to raise the plants with balls of earth about their roots, and consequently the transplanting might be very harmful. This difficulty is not encountered when the soil is heavy. The young trees can be balled easily and do not suffer at all in transplanting. Furthermore, Guérin is quite wrong in saying that the taproot is the essential part of the cacao, and that the least injury to it results in the death of the tree. In Trinidad, when transplanting is done on the plantations, the ends of the taproots of the nursery trees are cut off, and they do not suffer in the least.

Studies made at the Ivoloina Experiment Station by my colleague, Mr. Deslandes, have proved that the cacao tree, like most other vegetable species, undergoes transplanting and shortening of the taproot without any bad results. Be that as it may, planting directly by seeds is the method most employed. In Surinam both methods are used, but this one is used exclusively in Trinidad, Venezuela, Ecuador, Brazil and all the countries in which cacao planting is done on a large scale.

In Madagascar, so far, nursery trees are planted, but it is probable that seed planting will be done in the future, even though the results of attempts in this line at the Tamatave Experiment Station have not yet been satisfactory. In the valley of Mangoro, however, there is a small plantation that was started from seeds.

Planting by Seed.—Planting the seed directly, or as it is often called, "at stake," has, like planting nursery stock, advantages and disadvantages. By sowing the seed at stake, time is saved and the plantation can be established more quickly. It is probably this fact that has led to the adoption of this method in all the countries where cacao culture is carried on to a large extent, and where manual labour is scarce. Less skill is required on the part of the labourers to sow the seeds directly in the spot in which the cacao trees are to remain than to take the young plants from the nursery and transplant them to a more or less distinct place without breaking the cube of earth that protects their roots.

It is necessary to keep close watch just after the seeds are planted to defend the young trees against adventitious plants, which ordinarily grow with great rapidity. Insects may also cause damage by eating the plantlets at the time of germination.

Starting the plants in a nursery has the advantage, as was said above, of allowing the planter to make a careful selection, and plant only the well-formed and most vigorous specimens. Besides, while the trees are starting in the nursery—a period of from four to ten months and possibly longer—it is not necessary to cultivate the land. Trained workmen are required, however, for setting out the young plants. It is a slow process, and not the method usually employed in countries where cacao plantations are laid out on a large scale. But since both methods of installing a plantation are in use, I shall describe each one. Whichever method may be used a nursery is indispensable, for in plantations started from the seed replacing is always necessary.

Choice of Seed.—If in the country where the plantation is to be started there are a number of well-known varieties of cacao, of which the needs are also known, the first thing to be done is to choose the variety that will furnish a product of high commercial value, and at the same time to be best suited to the conditions in which it is placed. In Madagascar this question of choice does not arise as yet, for up to the present, except for the kinds introduced by the Department of Agriculture, which have not yet borne fruit, there is but a single variety in existence.

Choosing the seed-bearing trees is quite a different matter. These must be selected with extreme care, in fact it is the only way by which the yield can be improved. For this reason fruit for this purpose must never be taken from trees that are not prolific and healthy, and the fruits themselves must be well selected, the small or imperfect ones being thrown out. They must be picked as soon as they are thoroughly ripe, and as short a time as possible before planting.

If for any reason it is necessary to delay the sowing for some little time, or to send the seeds away, it is a good plan to open the fruit pods as soon as possible after picking, remove the seeds and place them in layers, alternately with layers of sand or mold in a packing case if they are to be shipped, or in a pile if they are to be planted near where they were picked. If the distance is not too great, it is better to keep the fruits intact until the seeds are placed in the ground; however, in this case it is necessary to use the seeds very soon, or fermentation will begin within the fruits and a number of seeds be rendered worthless.

When the planting is about to be done the fruits are broken and the seeds taken out. Inperfect seeds and those near the ends are rejected. In Madagascar it is reckoned that one fruit will provide not more than twenty-five seeds. From this it is easy to calculate in a general way the number of fruits needed if four seeds are placed in each hole. The seeds being removed from the fruit the watery pulp that surrounds them is next washed off. The planters of Surinam and Trinidad do not do this as a rule. They roll the seeds in lime or ashes and then dip them in citron juice, to protect them from the bites of insects.

If the hole has not been made in which the cacao is to be planted, it will be necessary to clear away the brush to a radius of 2 to 2·5 meters about the picket marking the place. The top of the soil is then broken over a surface 50 to 60 centimeters in diameter, the stake marking the centre. Then the seeds are placed in this space about 25 to 30 centimeters apart, at the corners of a triangle if three are planted, or at the corners of a square if four.

The seeds should be sown at a depth of from 2·5 to 3 centimeters, and the soil spread over them lightly. In Trinidad, where it is not the custom to dig holes, the method I have just described is followed, and the labourer plants usually "by the job," from 70 to 100 pickets, according to the condition of the brush. The clearing around these pickets and the breaking of the ground are of course included.

It is necessary to go over the ground frequently after the seeds are planted,

to make sure that the weeds do not overrun the place. In Dutch Guiana the ground about the young cacao is cleared thirteen or fourteen times a year. In Trinidad, where it is drier, six or eight times are considered to be sufficient. When the plants have attained a height of 20 to 25 centimeters, it is well to take out two or three, according to whether three or four seeds have been planted. The strongest plant is left of course, and the others are used for replacing where that is necessary. In some places the planters do not proceed in this manner. In Ecuador, for instance, it is the custom to leave two, three, four, and even more plants growing together. In the cacao plantations of Bahia, in Brazil, four plants are usually left.

The proprietor of large cacao plantations in Belmont, Bahia, explained to me that he believes this method is beneficial to the fruiting, because the four trunks tend, in growing, to move away from one another, and incline more and more as they become larger. The flowers which grow on the outer side of the trunks are thus sheltered from the rain, which would appear to make their development into fruit more certain. I give this opinion for what it is worth, but must add that I have seen a great many cacaos growing alone and very erect, whose trunks bear fruit in an entirely satisfactory manner.

The method of allowing several plants to grow together is out of place in regularly laid out plantations, where, I believe, the trees should be as regular as possible in form. However, since this method is employed in regions where cacao culture extends over immense areas, and since I have not had an opportunity to study its advantages or disadvantages, I am not in a position to either condemn or advise it. It is probable, nevertheless, that it is a method that can be successfully applied only where the land is particularly fertile.

Time for Sowing.—The time for sowing is necessarily determined by the times for the principal harvests, which occur in most of the countries twice a year. When the climate is very warm and the country situated near the equator, it is possible usually to plant at the time of one or the other harvest. When, on the contrary, the northern or southern limit of the zone for cacao culture is approached, it seems perferable not to sow until the time of the harvest nearest to the winter season, or, on the other hand, the harvest nearest the warm season. Observations made at the Ivoloina Station have confirmed this opinion.

In Madagascar cacao is harvested first in June and July, and again in October and November. It is at this latter time that the planters usually plant the seeds, either at stake or in nurseries.

In June and July the temperature is too low, and the plants growing from seeds planted at this time develop slowly and are puny. In the event of planting the seeds in November it would seem best to plant bananas in April or May. In Madagascar this time would probably be the best, for in Trinidad the planters prefer to set out the *Musa* during the cold season.

Sowing in the Nursery.—If it is desired to establish a plantation with plants already started, a nursery is evidently needed, but even when started directly from the seed, it is necessary to have a small nursery containing plants for replacing those which are not healthy, or seeds which have not germinated.

Choice of the Situation of the Nursery.—If a large plantation is being established, one nursery will not be sufficient, but several should be located at regular distances over the plantation, to reduce as much as possible the distance that the plants will have to be transported, as well as the expense incurred in thus transporting them. In Trinidad, for example, a nursery is installed for every area of about 10 hectares.

The site upon which the nursery is to be placed should have as rich soil as possible; and it is equally necessary that the soil should be heavy enough to permit easy balling of the roots when the plants are moved. Shelter from the wind is a third indispensable condition.

In order to procure for the young cacaos the shade they demand, it is not desirable to plant them under the shade of larger trees whose roots usually monopolize the soil to too great an extent. I have seen certain Dutch planters in Surinam sow the cacao seeds even in the midst of the cacaos on a plantation. The plants that resulted were usually so puny and of such slow growth that this would seem to be a serious mistake.

Preparation of the Soil.—The site having been chosen, it must be ploughed to a depth of 25 or 30 centimeters, working in by this means the amount of manure, ashes and mold that is considered desirable, and the stones and roots that are in the way can be removed.

After having thus ploughed and levelled the surface, beds are laid out, about 1·2 meters square, separated by paths 50 centimeters wide, so that the

coming and going necessary in weeding and watering the plants will be rendered as easy as possible. The beds are then levelled and the clods broken, after which six furrows 20 centimeters apart and 20 to 25 centimeters deep are made in each bed. The seed, having been prepared as described under "Planting by Seed," are placed at the bottom of these furrows at intervels of about 20 to 25 centimeters, care being taken to lay them with the flat side down. The surface of the bed is again levelled, covering the seeds lightly. Whether the surface is left bare, or is covered with a light layer of mold or sand to prevent it from baking, depends on the location. Sand has proven very satisfactory at the Ivoloina Experiment Station. In Trinidad, immediately after sowing, the ground is covered with banana leaves which are removed after germination begins.

Immediately after the sowing, if it has not been done before, shelters of some sort must be erected over the nursery. At the Tamatave station the shelters are about 1·8 meters above the ground. These provide the necessary shade without preventing the free circulation of the air, and are high enough so that the labourers can work underneath.

Solid pickets about 2 meters long are planted in regular lines through the beds. Their tops are connected by sticks about 4 meters long which support a network of smaller sticks, stalks of rafia, or small palm leaves. Over the whole are firmly attached branches of heath, found commonly along the shore. They are fortunate in having at Ivoloina plants which furnish sufficient and well-regulated shade. These shelters may be accused of being too costly, but in an Experiment Station permanent frames are necessary, because the same place is used year after year for new crops, and so far nothing more practical has been found.

The planter who has no use for such durable shelters may follow the planters of Surinam who lay palm leaves over frames that are about 1·5 meters from the ground and supported on solid poles. In Dutch Guiana I have seen this method followed with very satisfactory results.

The leaves being simply laid over the frames without being attached in any way, the intensity of shade may be varied as it is found desirable. Ordinarily in the plantations I have visited the young cacaos are not pricked, but this method has been put into practice at the Ivoloina station, where it has proved a success, the remaining plants undergoing balling and transplanting more easily. Pricking does not appear to be indispensable, and it would seem that people who are desirous of planting large areas with nursery plants could well dispense with it.

In Trinidad the nurseries for replacing trees are made in a very different manner. If the plantation is not a new one, and the shade trees are mature, spots in which the soil is very compact and which are not covered with heavy brush are chosen under the shelter of these trees. The ground is cleared of weeds, but not ploughed. Furrows 2 to 3 centimeters deep and 25 to 30 centimeters apart are made, and the seeds deposited in these furrows. The soil is then replaced and smoothed down, and banana leaves are laid above, which remain usually eight or ten days, or until the seeds begin to germinate, after which they are removed. Evidently this very simple method of establishing a nursery can be employed only where the cacao grows with extreme facility, and would be attended in such a place as Madagascar, for instance, with difficulty.

After the germination it is necessary to keep the soil clean by constant weeding. In the heavy lands of Surinam the surface of the beds is stirred up by means of little pointed sticks two or three times during the five or six months that the plants remain in the nurseries. This operation, which provides a free circulation of air in the soil, is a good one and should not be neglected. If the season is too dry it will be well to irrigate, or cover with straw, if need arises.

The length of time that the young cacaos remain in the nurseries varies according to the region. At Jagtlust (Surinam), where all the plantations are made by means of trees started in well-kept nurseries, setting out takes place four or five months after sowing. In Madagascar, from observations made at the Ivoloina Experiment Station, it is well to leave the plants in the nursery at least a year. In Trinidad the plants are set out eighteen months after sowing the seed. It is the opinion there that they should not be set out until they begin to form branches. I have seen trees nearly three years old transplanted with very good results.

The best time for setting out the young plants is certainly the warm and rainy season, but in countries where it rains practically the whole year it is possible to plant at any time, though it is preferable to wait until the vegetation takes a new start. In Tamatave setting out may be done from December to

March, though December and January are the best months, so that the young plants may be well started and will not suffer so much during the cool season. The plants should be very carefully raised with as large balls of earth as possible. If they are transported any great distance, it will be prudent and even necessary to cover the balls with banana leaves or green herbs to prevent breaking. On the contrary, if they are set out near the nursery it will suffice to place them carefully side by side in a case in which they can be carried to the location desired, and set in place at once by the plantation labourers.

It is not wise to take up a large number of nursery plants in advance, and those that are taken up should be protected from strong sunshine. If the planter is compelled to set out his trees during dry and sunny weather the process should be discontinued during the heat of the day. Neither in Dutch Guiana nor in Trinidad do they strip the leaves from the plants. But if the weather is at all dry they cut off parts of the leaves in order to diminish evapoartion.

In certain mountainous plantations in Trinidad I have seen the taproot cut off with a knife where it projected beyond the ball; and in other plantations situated on the lowlands, on the contrary the taproot is preserved in its entirety and placed carefully in the whole that is made especially deep for this purpose. When I asked the manager of the plantation the reason for this, he said that in the Arinao districts the cacaos were very much exposed to the winds, and the plants whose tap roots had been broken off at the time of planting offered less resistance to the wind than those which the taproots had been carefully preserved.

In setting out, the plants should be placed deep enough so that the top of the ball will be covered with soil to a depth of 3 or 4 centimeters. If a dry period follows the setting out it will be necessary to irrigate the plants whose balls have been broken. This precaution should not be neglected if regularity of the plantation is to be maintained from the outset. I know that planters in the great cacao-growing regions will smile if they read this, but I am writing it for the benefit of the planters in Madagascar, where the climate is such as to make necessary precautions that would be superfluous elsewhere.

There is one method of preparing the plants that I have not mentioned, that which consists in sowing the seeds in baskets, pots, or better in bamboos of a certain diameter. It is everywhere employed in Government establishments whose mission it is to furnish plants to individuals. The method must have its advantages since it is used, but it has also numerous disadvantages, which would prevent its regular use by those who plant upon a large scale.

CANE SEEDLINGS IN JAVA.

BY J. D. KOBUS,

(From the *Louisiana Planter and Sugar Manufacturer*, Vol. XLII., No. 18, September 18, 1909.)

It is just twenty-five years since Dr. F. Soltwedel began his experiments in the propagation of sugar cane and other species of *Saccharum* from seed.

Though he was not at once so fortunate as to raise young sugar plants, yet by 1885 he got some seedlings from *Saccharum spontaneum*, and the next year from another *Saccharum* species that grows wild in Java and was named after him *Saccharum Soltwedeli*. In 1886 he found also that the pollen of the Louzier cane, imported by him from Mauritius, would germinate, and in 1887 he succeeded in getting seedlings from several varieties. Most of them, however, died when young. Only those of a yellow cane, known as Havaii, developed into vigorous cane stools, very much resembling the parent plants.

At that time Soltwedel was unaware that his discovery was not new, and that already as far back as 1860 and 1861 canes grown from seed had been reared in Barbados and in Java, and that in Barbados several acres had been planted with the descendants of these seedlings. No report, however, was found dealing with these facts, neither in books on cane culture nor in botanical treatises on sugar cane. The invariable statement made was that sugar canes did not produce seeds and were only propagated by cuttings.

At nearly the same period as Soltwedel, and quite independent of him, Harrison and Bowell, in Barbados, succeeded in growing cane plants from seed. Shortly afterward their experiments were repeated all over the world where sugar cane grows, and though there were many failures, successes were now and then registered.

For the first few years the discovery had only a scientific value, and many experiments had to be made and several drawbacks to be surmounted before the cane growers got their share in the success.

As regards the other cane-growing countries, there are abler pens than mine to express the value of their results with cane seedlings ; I will limit myself, therefore, to those obtained in Java.

When Soltwedel made his experiments he prepared the small cane fruits from the surrounding glumæ, a practice that we did not follow in later years because it was too troublesome, but he learned thereby that in many cane varieties there were only very few flowers that gave mature seeds. In his experiments, the arrows of most varieties produced under 1 per cent., and only one cane (*Branche blanché*, from Mauritius) gave 31 per cent. seeds. These seeds (properly fruits) were very small ; their weight varied from 0·10 to 0·22 mgrms.

One of Soltwedel's assistants, Dr. Benecke, published in 1889 Soltwedel's results and his own, a report that was chiefly remarkable for a series of drawings representing the germination of cane seeds and young cane plants, aged from some days to over a month, that made it easy to recognise them and to distinguish them from other young grasses.

In 1888 I myself tried to raise cane seedlings, but did not succeed until 1890, when some varieties introduced from the Fiji Islands, that arrowed abundantly, gave me a lot of seedlings, of which, however, only fifty survived. A year later Moquette, one of our cleverest managers, discovered the reason why so many seedlings died when young. We used to sow out the cane seeds in the shadow in the sandy soil. Moquette made use of a heavy fertile soil, placed the boxes filled therewith in the sun and took care that the soil did not dry up.

After this discovery we got better results. As early as 1892 Moquette had already a field with 5,000 seedlings ; twelve months afterward Bouricius and Nash found in and near fields planted with Fiji canes several hundred young plants, and in 1894 Bouricius succeeded in crossing the Fiji cane that produced large quantities of pollen, with our Cheribon or Black Java cane, the flowers of which are all female, or nearly so, since the pollen only rarely reaches its full development.

Dr. Walker published in this year interesting researches on cane flowers. He found that flowers of different varieties vary very much ; some have normal flowers, with well-developed pistils and stamens and good pollen ; in others most of the pollen has dried up and self-fertilisation is, of course, very doubtful. Again, in other varieties all the pollen is quite dry or else has not developed at all.

Some canes that arrow freely have flowers that contain inside the glumæ, only an irregular tissue bearing many membranes and filaments resembling pestils. Stamens and ovaries are absent. One variety has its undeveloped flowers hidden in the sheath of the highest leaf, so that the inflorescences much resemble those of the cauliflower. Finally, we have several varieties in Java of which, till now, flowers have not been seen.

Walker's results elucidated many points that we could not understand before, amongst others the fact that the discovery of cane seedlings in Java did not take place at an earlier date, because the prominent varieties were nearly sterile when left to self-fertilisation.

The results just mentioned induced several managers to start seedling experiments, but, though many of them succeeded in raising large quantities of cane seedlings, nearly all these perished the second year from sereh or other diseases. Only two varieties of all those bred during this period and introduced into the cane fields of the factories succeeded in dislodging the Cheribon cane by their superior qualities. The increasing sugar production in Java is partially due to the introduction of these seedling canes, viz., No. 247, bred by Mr. Bouricius, a crossing from the Cheribon and Fiji (*Canne morte*) canes, and No. 100, got casually by Dr. Walker from a black Borneo cane and an unknown father.

The very superior qualities of our black Java (Cheribon) cane, only checked by its liability to disease, made me cross it, when I returned in 1897 to the East Java Experiment Station with the Chunnee variety, a very thin cane, though with a juice rich in sugar, that I had imported from Bengal some years before, and that was entirely immune from sereh and the root disease, which, in many parts of Java, rendered impossible the cultivation of Cheribon canes and of several other varieties.

The expectation that the seedlings would inherit the immunity of the male parent was quite fulfilled. Till then we had seen a large majority of the seedlings perish in the second year from the sereh disease, and nearly all the other in the third and fourth years. Once from a remarkably fine set of 1,700 seedlings, after four years, we had not one left ; all died from sereh.

The crossing I effected in 1897 showed, on the contrary, after four years, not a single descendant affected by this disease. Encouraged by these results, I continued the crossing of these two varieties for several years, and only a very few of the descendants appeared liable to sereh or root disease. On the other hand, several of them had to be rejected because they were too thin, some canes not being thicker than one-fifth on an inch; again, others would not do because the fibre contents were too high, but a large proportion could compete with the two varieties named before, and, especially in the Eastern part of Java, many thousand acres are now covered with the descendants of of our seedlings, Nos. 36, 139, 213, 228, etc.

In 1901 Mr. Moquette was the first manager who had all his cane fields planted with seedling canes; in 1908 probably the majority of our factories did so. While twenty-five years ago, in Java, probably 99 per cent. of the cane fields were planted with Cheribon canes, nowadays perhaps only 10 per cent. are not yet replaced by seedling varieties. Among these, Nos. 247 and 100 are now prominent, each of them covering 30-35 per cent. of the whole surface under canes, while nearly 20 per cent. of the area is planted with our own seedlings. No. 247, however, is not quite immune against the sereh disease, though not affected in such a way as the Cheribon cane, and No. 100 is rather difficult to rear having regard to the quality of the soil.

We are trying now to breed new varieties, superior to those already cultivated, and I intend to give a short review of the methods by which we hope to arrive at our goal.

In the first place we have to consider the good and bad qualties of the parent canes, since these are hereditary in a high degree. Cane varieties liable to disease ordinarily give seedlings that suffer badly therefrom; canes rich in sugar show this property in their progeniture; the yellow spots on the leaves of the Chunnee cane are found in nearly all its descendants, and likewise its immunity against disease.

The flowers of such varieties as we intend to use for breeding seedlings must be examined by the microscope to ascertain whether stamens and ovary are existent and of a normal structure, and whether the pollen is fertile. This can be verified by iodine solution, since pollen without amylum are never known to germinate.

When we intend to cross two varieties, of course, only those can be made use of that flower at the same time, and as in Java the flowering time of different cane varieties extends from January till July, it is probable that some desirable crossings cannot be effected. For crossing purposes, we like to take as female plants varieties without fertile pollen, to make sure that there is no doubt about the parentage of the seedlings.

To prevent fertilisation by undesired pollens, we cover the arrows with cloth-covered baskets. For self-fertilisation, it is sufficient to cover one single arrow; for cross-fertilisation, another arrow is tied up in the same basket. Cane flowers open their stamens early in the morning hours; most varieties at 5-6 a.m., some others till 9 a.m. After 9 o'clock, pollen can rarely be found in flowers that opened in the morning, and are fit for cross-fertilisation (in some varieties the pollen grains stick together and are not spread by the wind),

As five days elapse before all the flowers of an arrow have opened, we usually insert male arrows in the basket for five successive days, choosing such arrows of which we were sure a part of their flowers would open the stamens next morning. To prevent the drying up of the stamens in the night, the male arrows are placed in a bamboo filled with water. The cloth-covered baskets that are used to breed pedigree seedlings, are protected by a large hat to prevent the rain spoiling the pollen and the fertilised flowers.

In this way we are pretty sure to get such crossings as we desire, though there are instances where flowers with well-developed ovaries did not give one single seedling, notwithstanding that they were crossed with very fertile pollen. The reason why this has not been discovered so far, a microscopical examination showing nothing abnormal in the structure of the ovary. One unexpected drawback, however, was met with in later years, when we found that cane varieties rich in sugar only rarely have good pollen.

With such crossing as have proved a success and that are repeated every year, we select the parents the year before by chemical selection, to have some certainty that not only the cane variety used, but also the individual parents are rich in sugar. During one year, by comparing over a thousand seedlings of canes poor in sugar, with as many seedlings of parents belonging to the same varieties but rich in sugar, we found that the latter were the best

and scored 10 per cent. more in sugar and 20 per cent. more in weight.

About three weeks after fructification the seeds are ripe and the arrow is divided into small parts. The thin arrow branches with the adhering glumæ containing the seed are spread out on the soil, pressed on it, and well watered. As we have already mentioned, we prefer for this a heavy fertile soil, and the earthernware pots we use are placed in the tropical sun without any covering, except at night time, when heavy rains come on—that might uproot the young seedling canes.

The seeds begin to germinate on the third day and continue to do so for a fortnight or more. In some sowings not one seed germinates, in others after three weeks the soil is quite covered with the young cane seedlings, such that on a square foot nearly 4,000 have been counted and the pot resembled part of a lawn. When the young plants are four to six inches high they are planted individually in small pots with fertile soil, and there they are left till they have grown to the length of one foot or more, when they are planted out in the cane fields. After the young seedlings have been put into the small pots no losses of any extent have to be registered; in fact, it not infrequently happens that all the transplanted seedlings will reach maturity.

In Java this takes place within one year. Sometimes the seedlings grow so luxuriously that they weigh over fifty pounds, but, of course, these are exceptions, and moreover, such heavy plants are generally poor in sugar.

Notwithstanding that we have learned how to avoid many of the difficulties met with in the breeding of cane seedlings, and every year new hints are assimilated in the course of our experiments, the breeding of a very superior variety is a mere chance. To increase this chance we cultivate as many seedlings from parents with the desired properties as possible; the last five years we have got each year between 16,000 and 32,000. Easily germinating seeds from parents liable to disease are not made use of; at least, one of the parents must be immune.

Several crossings, that suggested themselves as desirable, did not prove a success. All those, for instance, of the seedling variety No. 100, one of the best cultivated in Java, rich in sugar, poor in fibre, but rather delicate in regard to the quality of the soil, crossed with the other varieties, also rich in sugar and not so sensible for soil qualities, have given till now bad results, though no lack of experiments have been made. Because the properties of the seedlings depended on those of the parent canes, we have tried for a few years to make crossings that united in them the qualities of several varieties. Seedlings from these will, we hope, show such a wide range of variation that there is a good chance of producing a variety with still better qualifications than the ones now in cultivation.

When the seedlings are one year old all those plants that are deficient in exterior qualities are rejected and only those that look well from a cultural point of view are brought to the laboratory. There every plant is analysed separately, and only the cuttings of those that were rich in sugar are planted. In 1897 we chose as a limit a calculated production of four tons of available sugar per acre; since that year the sugar production in Java has so increased, chiefly from the introduction of the older seedling varieties and a more rational culture, that we raised our lowest limit to nearly seven tons per acre.

Ordinarily over 90 per cent. of the seedlings are rejected in the field, and of those analysed, as an average, only 0·25 per cent. are rich enough in sugar to warrant replanting. After one year there, two selections, one in the field and one in the laboratory, are made again, whereby the surviving seedlings are reduced to nearly two-thirds, and as we go on in this way for four years selecting the good varieties and rejecting the bad ones, only very few seedlings are left at the end of that period, and at the same time multiplied in such a way that we have got enough plants to make it possible to try their value in our experimental fields against the older selections. If they stand this trial their cuttings are, a year afterward, put at the disposal of the sugar factories. We never analyse samples of our canes, since it is impossible to make average samples of a few cane plants; therefore, we send all our canes through the mill and analyse the juice.

The results of the breeding of cane seedlings in Java are very good, and, what is more, the seedlings were at the disposal of the factories just when they were the most needed. When first the sereh disease attacked the sugar canes in Java, the ruin of the sugar industry was prevented by the import of cuttings from those parts of the island where the disease had not spread. This, however, was only possible for a few years, since as early as 1890 the whole island was

infected. The sugar planters then had recourse to the cultivation of young canes in the mountains; these were cut when they were only 6-8 months old, and could be used entirely for cuttings. At the same time, experiments with foreign canes were made on a large scale, and for some years the Lousier and the Canne Morte (Fiji) canes had some success. Both, however, showed themselves after a short time liable to the sereh disease, and the cultivation of cane cuttings in the mountains had to be stopped in many parts of Java for the same reason.

A root-disease, that caused many hundreds of acres planted with canes to dry up entirely, made its appearance in the nineties, and heavily affected Cheribon, Louzier, Canne Morte, and some other varieties. But just at this time the first seedling varieties were at the disposal of the factories, and at once proved a success, some of them doubling their output in one year. All the varieties that had been tested on the heavy soils * in the experimental fields of our station showed good results, proved quite or nearly immune against the sereh and root disease, so that the heavy losses sustained in previous years belonged to the past.

Nowadays, in the eastern part of Java, only seedling varieties are cultivated; in the western provinces, where the climate is more favourable for cane culture, the best soils are still used for the old Cheribon cane, but here also the larger part of the soils is planted with seedling canes, and the rapid increase in the Java sugar-production from 2·5 ton per acre in 1887 to over 4·5 tons per acre in 1908 is chiefly due to the cultivation of seedling canes.—*Internatianal Sugar Journal.*

THRESHING GRAIN.

WITH STONE ROLLERS.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 10, October 1. 1909.)

The following article, written by the Deputy Director of Agriculture, Bellary, has been forwarded to us by the Honorary Secretaries of the Central Agricultural Committee, Madras:—

A few facts relative to the method of threshing grain by means of stone rollers are here collected, in the hope that those interested may be induced to give it a trial on their own lands.

There are three methods of threshing grain generally practised in this Presidency: treading by bullock power; beating with sticks, and the method of which we are now writing, crushing with a roller. The last is not suited for every sort of grain, as for instance in the case of Korra (Tenai) and paddy, crops possessing soft fine straw, it has been found that the straw becomes felted or packed into masses which protect the ears, and thus hinder the free extraction of the grain. Even in the case of the sorghum crop, for threshing which this implement is most largely in actual use, it is not every variety that can be dealt with in this way: Irungu cholam, a variety grown in the south, must be beaten with sticks since it possesses glumes which adhere very strongly to the seed and other methods will merely cause the seed to separate with the glumes. It will be found, however, that if the directions given below are followed, most of the commonly grown varieties of sorghum as well as Sazza (Cumbu), gram, safflower, and no doubt other crops, may be more economically threshed by this means than by any other.

The history of the introduction of the stone threshing roller is given by the late Rao Bahadur C. K. Subba Rao as follows:—

"In the famine years of 1876-78 stone rollers were very much in evidence in connection with the opening of new and the repair of old roads. A certain intelligent ryot of Pedda Settinapalli, Proddatur Taluq, Cuddapah District, observed that when one of the stone rollers accidentally moved over a heap of Jonna ears, the grain was well threshed. He piled cholam ears to a height of about a cubit in a circular strip about 3 ft. wide, and had the roller drawn by a pair of bullocks. He found that the roller was far more economical than the usual process of treading by several teams of bullocks."

The roller is thus the ordinary stone roller such as is used for road making, and will be generally about a yard long and from 1½ ft. to 2 ft. in diameter. A roller of these dimensions will weigh from 1,000 to 1,500 lbs. The cost varies in different districts from Rs. 10 to Rs. 20. Their first cost is thus somewhat high, but they are frequently the joint property of several owners who will borrow them in turn to thresh their grain.

* The culture and propagation of seedlings on heavy soil is much recommended in Java, because those liable to disease disappear in the first years, while otherwise good varieties raised and propagated on fertile sandy soils may suffer very badly as well from the sereh as from the root disease, when introduced on heavy soils.

THE PROCESS DESCRIBED.

In using this roller, the preliminary operations of harvesting and drying the grain are performed as usual. If a large quantity of grain is to be treated, the heads, after removal of the straw, are simply spread out in a circle over the threshing floor to the depth of about 8 inches, and the roller is driven round and round over the whole mass. More generally, however, there is a clear space left in the middle, and the bullocks are driven in a regular concentrical manner over the circular strip until the grain is as thoroughly extracted as possible. After each passage of the roller, men with light wooden rakes turn over the heads so that a fresh surface is exposed each time. A little water is occasionally sprinkled on the ears if it is found that the grain is being powdered. The roller being cylindrical and being continually forced to travel in a comparatively small circle, a considerable amount of friction is caused, and there is no doubt that to this rubbing the efficacy of the process is largely due. It has been suggested that a roller shaped as a frustrum of a cone would perform the work more effectively and be less fatiguing to the bullocks, but though easier to pull it would probably not be so effective, while it would have the additional disadvantages of being useless for anything else, and extremely difficult to move from place to place.

During the process, the grain is rubbed and pressed free of the ears, and, being heavier, gradually works to the bottom whence it can be readily collected at the close of the operation. The extraction is not, however, complete, 10 to 20 per cent. of grain being still left in the earheads. This will have to be extracted by beating with sticks, or, if the quantity is large, it may be trodden out by bullocks in the ordinary way. A combination of the two systems which could only be carried out in the case of large quantities of grain is as follows:—Behind the roller drawn by two pairs of bullocks are driven two teams, each of four bullocks which tread on the compacted mass of heads. This is reported to thresh four times the amount of grain threshed with the roller alone.

The relative economy of the two processes may be gauged by the following figures, which were obtained in an actual trial with the white sorghum. (Tella Jonna) of Bellary. For threshing 9,812 lbs. of grain completely from the heads by means of the roller, two and a half pairs of cattle, eleven men and two boys were engaged, at a total cost of Rs. 3-10. For completely extracting 4,552 lbs. of grain by the treading method, five pairs of cattle, seven men, and two boys were employed at a total cost of Rs. 4-2. The cost of threshing 1,000 lbs. of grain was, therefore, under the two systems—As. 5-11 —and As. 14-6, which is very nearly in the proportion of 2 to 5 in favour of the roller. This takes no account of the prime cost of the roller.

Since its first introduction in the Proddatur Taluq of the Cuddapah District, its use has spread slowly though its advantages are known and appreciated. The main obstacle to its more rapid adoption is the cost of the roller, though this difficulty is often met, as noted above, by joint purchase, or the roller can often be hired or borrowed from one of the bigger landlords in the village. It must be noted further that the roller though more economical in bullocks yet requires the services of more men. The small ryot who owns only one pair of cattle will go with them to his neighbour's floor, and there he and three others can do the whole work with but little extra assistance. Each one of the four will thus get his threshing done in turn with but little actual out-of-pocket expenditure, since there is no other work for the bullocks at that season, while, if the roller is to be used, coolies may have to be hired and paid for. The practice is, however, spreading among the larger ryots to whom the first cost is less important, and who are more concerned with the economy of the process, and there is little reason to doubt that its introduction would prove economical to the same class in other sorghum growing districts with benefit, also to the smaller landholders who could on occasion borrow the roller for their own use.

TIMBERS.

UTILISATION OF WASTE WOOD.

(From the *Indian Trade Journal*, Vol. XIV., No. 175, August, 1909.)

Inquiries are from time to time received at the Imperial Institute from firms engaged in working forest concessions in British possessions as to the possibility of utilising waste wood produce in the ordinary timber-working operations. It has been thought desirable, therefore, to compile a short article on this subject with a view to affording general information as to the possibilities in this direction. The article in question is published in the *Bulletin* of the Imperial Institute, Vol. VII., No. 1, and from it we take the following particulars :—

Apart from its use for structural purposes there are two main ways in which wood can be utilised at present, viz., in the manufacture of wood pulp for paper making, and by destructive distillation for the production of wood spirit, Stockholm tar and wood charcoal. For these purposes the cheaper woods are available, and for destructive distillation especially the waste products of the various timber industries are suitable.

Much of the wood refuse generally available, such as shavings, sawdust, chips, spent dye and tan woods, etc., is at present used as fuel, its value for this purpose being a few shillings per ton. In considering the disposal of such material it is important to ascertain whether local conditions will permit of the disposal of distillation at a higher rate than would be obtained for the raw material as fuel. Indeed, in undeveloped communities where wood spirit, tar and charcoal are not saleable in large quantities, the destructive distillation of wood refuse is not likely to be remunerative or even feasible.

From air-dried wood about one-third of its weight of charcoal can, as a rule, be obtained, this having an average value of from 17s. to 22s. per ton in districts where coal is not readily obtainable. Thus, from one ton of air-dried wood refuse, containing from 20 to 25 per cent. of water, and consequently worth from 4s. to 5s., the value of the charcoal would be about 6s. In most countries there is little difficulty in disposing of the charcoal, as its uses are numerous. Besides being largely employed in the manufacture of iron and steel and in the extraction of other metals, such as copper and tin, it can be used in sugar refineries for filtration and for various domestic purposes. Special uses for the "small" charcoal obtained by distilling wood refuse are found in the manufacture of certain kinds of "smokeless" fuels, calcium carbide, and for packing cold storage chambers.

Wood refuse can be carbonised more rapidly and at a lower final temperature than blocks of wood, a temperature only 300° C. being adequate. One result of this is that the pyroligneous acid obtained in the distillate is of good quality, and fairly readily purified to yield acetic acid. Wood refuse is also more readily dried by exposure to the air, and does not require to be stored for a year or two before its content of water is reduced to from 20 to 25 per cent. which gives the best results, as is the case with blocks of freshly-cut wood.

DESTRUCTIVE DISTILLATION OF WOOD.

In the destructive distillation of wood the blocks or refuse are heated in a suitable vessel provided with a small aperture fitted with a pipe. In modern practice the carbonising vessel is generally a cylindrical wrought-iron retort built into brick-work in a horizontal position. The retorts are of an average size of 3 metres long by 1 metre in diameter, and are made to hold anything up to about four tons of wood (a quarter of a "cord"). They are generally set up in "batteries" of two, and heated by the same fire from below. The naked flame is not allowed to impinge directly on the iron retorts, which are heated only by the hot furnace gases, this result being obtained by utilising iron or brick shields or arches. Before the application of heat all the orifices and connections are plugged with clay. The batteries of retorts are set up in rows, and the exit of each retort is connected with a warm condenser made of copper, and cooled externally by means of running water.

When the wood to be distilled is sawdust or scraps of very small size, such as spent tanning materials, dye woods, etc., it is generally advisable to have the plant arranged in a special manner owing to the necessity of having the wood quite dry, This result is frequently obtained by building the retorts in such a manner that the hot gases from the one distillation are used to dry the wood refuse ready packed in another retort. The retorts are also sometimes made on a rotary system to facilitate even drying, and thus prevent unequal carbonisation.

A special form of kiln is said to be adopted on many of the large wood-distillation plants in Sweden, capable of treating wood in all conditions—sodden forest timbers, saw-mill waste and ordinary air-dried logs. The general arrangement of the furnace is in the form of a long tunnel through which pass open steel cars, on which the wood is vertically stacked. The carts are taken through the furnace at an average rate of 22 per diem for perfectly wet wood, and about 36 per diem for air-dried timber. Uncondensed gases from the distillation are returned to the furnace and burnt, thus practically dispensing with the addition of any further fuel.

On the application of heat to the retort the substance of the wood is charred with the formation of volatile products, which are driven off. Those which are condensable are liquified again in the condensers, and collected in suitable receivers.

PRODUCTS OF DISTILLATION.

Although the process of distillation is practically identical whatever the kind of wood employed, the products obtained are different according to whether "hard" or "soft" wood is used.

Products from Hard Wood.—Most of the wood distilled is hard, such as beech, birch, maple, etc., and is practically free from resinous constituents. Four chief products are obtained, viz., (1) an inflammable gas which escapes from the condenser, and should, if possible, be returned to the fire to aid in heating the retorts; (2) a watery liquid known as "pyroligneous acid"; (3) wood tar, which is condensed with the pyroligneous acid; and (4) charcoal, which remains behind in the retorts.

The tar itself may be used as the fuel to create the heat necessary for distillation, and in this case it is sprayed with a jet of steam and used in a similar manner to "oil fuel." In this manner the use of coal as fuel may be avoided completely.

The charcoal is allowed to cool for a day or two either before removal or in specially-devised "cooling chambers" out of contact with the air, or else it is drenched with water immediately after extraction from the retorts to prevent its spontaneous combustion in the air and consequent loss.

Purification of the Products.—The tar and the reddish-brown pyroligneous acid are run off together into large settling vats, where separation is effected by the tar collecting at the bottom. Each is then distilled separately. As the tar and the pyroligneous acid are to a certain extent mutually soluble, the residue from the latter contains a quantity of tar, and the distillate from the former is distinctly acid in character. If the tar is to be utilized as fuel the acid is removed by passing the acid tar downwards over "bafflers," where it is met by an upward current of steam or vapours from the stills to which the pyroligneous acid is given up. The chief products obtained by distilling the wood tar (which is itself an article of commerce) are light and heavy wood oils, wood creosote and the well-known product wood pitch, which is left behind in the stills.

In the most modern treatment of the pyroligneous acid an arrangement of plant known as the "three-still" system is adopted. In the first and largest still the crude acid is heated, whereby the volatile acetic acid and "wood spirit" are driven off, and most of the dissolved tar is left behind. The outlet pipe carries the vapours into the second still and passes them through a thin cream of lime and water. This absorbs the acetic acid with the production of calcium acetate, but does not affect the wood spirit, which passes on and is treated afresh in the third still in order to remove the last traces of acetic acid. In this manner the distillate eventually obtained is free from acid, and by suitable rectification can be made to yield pure methyl alcohol, commercial wood spirit and wood naphtha. The thin paste of calcium acetate remaining in the stills is run out and concentrated in large iron pans until it contains about 84 per cent. of "acetate of lime." This is the product which comes on the markets as "grey acetate of lime."

Application of the Products.—The uses of charcoal have been enumerated above. Most of the acetate of lime is subjected to dry distillation, and is thus converted into acetone and calcium carbonate (chalk). The increasing consumption of acetone in chemical industries has rendered this process one of considerable importance. Besides being a useful solvent for varnish resins, acetone is largely used in the manufacture of smokeless explosives and celluloid articles, and its use will very probably be greatly extended in the near future. The present price of acetone is about £60 per ton, and it takes about 40 tons of wood to produce one ton of acetone. The by-products in the distillation, so-called "acetone oils," are also useful as "paint removers." Their formation is due to the presence in the pyroligneous acid of organic acids higher than acetic acid.

Pure acetic acid is also prepared from the acetate of lime by distilling it with sulphuric acid.

Wood alcohol is used very largely for technical purposes. It is a useful solvent, and is widely applied for producing form-aldehyde, for "denaturing" ordinary alcohol, and in the coal-tar dye industry.

Products from soft wood.—When "soft" woods, *i.e.*, resinous woods, such as those obtained from the various pines, are destructively distilled, the substances obtained are as follows :— (1) inflammable gas ; (2) light oils ; (3) pyroligneous acid ; (4) tar ; (5) charcoal. The pyroligneous acid so manufactured is inferior in quality to that afforded by hard woods. The principal fraction is the "light oil" which is usually collected in two portions, of which the lower boiling one is a kind of crude turpentine oil. This is a dark red oil of unpleasant odour, but after suitable treatment and fractionation it yields a nearly colourless spirit of characteristic odour, which is used as a substitute for ordinary turpentine oil. (Compare this *Bulletin*, 1906, 4. 215.) The best yields of products in this process are obtained from the heart wood.

STEAM DISTILLATION OF WOOD.

Besides the method of destructive distillation described above, a process of distillation with steam is gradually finding extended use for obtaining valuable products from waste pine wood. This process only occasions the separation of volatile products (turpentine oil) already pre-existent in the wood.

Pine-tree stumps, saw-mill waste, and sometimes pine timber itself are cut into chips and placed in a vertical retort fitted with a steam injection pipe. Through this pipe saturated or superheated steam is blown in, and turpentine oil, which is readily volatilised, passes out of the retort and collects with the water in a receiver, where it may be readily separated.

The residual wood, after drying a short time in the air, is suitable for fuel. The crude turpentine is rectified from a copper still, and yields a slightly yellow spirit of an agreeable odour which is readily saleable at a price slightly below that of ordinary turpentine oil.

ELECTRIC PROCESS FOR THE DISTILLATION OF WOOD.

It is stated that a new electric process has been evolved recently in British Columbia for the utilisation of waste wood, and that the process combines destructive distillation with a primary distillation of the free turpentine oil contained in the wood. An experimental plant has been set up at Vancouver, B. C., where waste firewood is obtainable from local saw-mills, and the electricity from water-power at a low cost.

The wood is filled into oblong cans constructed to fit into special retorts, the brickwork of which is permeated with wrought-iron strips, through which passes a current of 110 volts. The temperature of the vessel, as measured by direct reading pyrometers, rises from 75° C. at the start to 130° C., when turpentine oil begins to volatilise. The current is then shut off, radiation from the brickwork sufficing to complete the distillation. By the time the temperature of the can has risen to 150° C. on the outside and 205° C. in the interior, the turpentine oil has been nearly all removed. It is collected by condensation with cold water as in the ordinary process. The rosin contained in the wood melts and runs down to the bottom of the vessel and out through perforations, and is collected in the bottom of the retort.

The can containing the wood is now removed from the turpentine oil retort into an adjoining still, where the heating is continued, and the wood residuum is destructively distilled as previously described. In this way the fresh set of products, charcoal, wood-tar, etc., is obtained quite separate from the turpentine oil and rosin of the first distillation.

It is stated that by this process the following yields are obtained per 1,000 lb. of wood from British Columbia coast fir :—

Turpentine	... ...	6·7 galls.
Rosin	... ...	168·0 lb.
Tar oil	... ...	5·1 galls.
Tar	... ...	68·0 lb.
Charcoal	... ...	323·0 lb.

The charcoal obtained is said to be of good quality, tough, and suitable for special purposes.

Owing to the absence of cheap supplies of raw material, wood distillation is not widely practised in the United Kingdom, but the distillation of sawdust, scrap-wood, spent tan and similar materials is carried on to a small extent.

In many of the Colonies and Dependencies large tracts of forest exist frequently containing trees of little value as timber, and these might well be used in this way, where the products of distillation, and especially the charcoal, are marketable locally. In Canada, wood dis-

tillation is greatly on the increase owing to developments in the consumption of charcoal.

In Natal, attention has been directed recently to the possibility of using wattle timber for destructive distillation after the valuable tanning bark has been removed. At present this timber is used for pit props and in other ways, but the demand for it is said to be much below the supply.

Wood distillation has been undertaken recently in Victoria, Australia, and a large works has been opened near Warburton, drawing its supplies from the forests of Gippsland.

In India also there would appear to be a possibility of extending this industry. Owing to the religious prejudices of the natives it is necessary to use only wood charcoal in the refining of sugar intended for native consumption. This and the common practice of covering "go-downs" with tar-impregnated felt opens out in India a market for two of the chief products of wood distillation.

PLANT SANITATION.

MISCELLANEA: CHIEFLY PATHOLOGICAL.

BY T. PETCH, B.SC., B.A.

A disease of Tomato plants, one which is most probably not new to Ceylon, but which has never been previously recorded, has recently been sent in for examination. The plants were grown from English seed, and developed normally until they reached the fruiting stage. Some of them then began to die off. Although the weather at the time was excessively wet, their leaves wilted just as they might be expected to do in a prolonged drought. The wilted leaves decayed and fell off, and finally the stems decayed also. There is very little evidence of disease in the stem when the leaves begin to droop, but if it is cut across near the base the woody part immediately round the pith is found to be brownish, and minute white or yellowish drops of liquid ooze out from this region. These drops consist of enormous numbers of bacteria, and if sections of the stem are examined under a microscope, they are found to issue from the vessels of the wood which are completely filled by them. The vessels convey the water from the roots to the leaves; and they are unable to perform this function when they are plugged by masses of bacteria. Hence the leaves wilt because they are deprived of water, although it may be raining heavily at the time. In dry weather, plants attacked by this disease merely dry up, but in wet weather they decay rapidly owing to the rapid growth of various saprophytic fungi, etc., on the moribund tissues.

The bacterium is, as far as can be ascertained without elaborate bacteriological investigation, *Bacillus solanacearum*. It is well known as the cause of wilt disease in potatoes, tomatoes, and egg plants in the United States, and has recently been recorded on potatoes in Mysore, where it causes "Ring disease." There is no treatment for the disease, except the removal and burning of diseased plants as soon as they begin to wilt. The bacteria live in the root and the base of the stem, at least in the early stages, and, therefore, the plants must be dug up with the roots. They must be burnt; if they are thrown on the rubbish heap they merely spread the disease. As the bacterium attacks many species belonging to the potato family, it is a waste of time to plant tomatoes, or brinjals, or cape gooseberry on the same ground for the next two years. Tobacco and chillies would probably be attacked also.

The root disease caused by *Poria hypolateritia* has hitherto been recorded only from estates above an elevation of 4,000 feet, and hence it was considered purely an up-country tea root disease. During the last few months specimens have been sent in from new clearings in the Kandy, Matale, and Kegalle districts. In each case the plants attacked were about two years old. The roots of these plants were covered with the red sheet of mycelium, or were mottled, red and white, when the mycelium had been injured. The fructification is rarely found on old tea bushes killed by this disease, but on these young plants it was present in several instances; it is a thin, pinkish or reddish sheet, studded with minute holes, and is always found at the collar of the plant, sometimes extending over the surface of the soil. The full details of this disease have not yet been worked out, The mycelium on the exterior of the root points to a spread from some jungle stump, but up to the present time the fungus has not been connected with any species of

jungle tree. It is known to occur on rotting logs in up-country jungles, and it has been found on the roots of *Croton lacciferum* (Keppitiya), but in the latter case it had attacked the plant in the same way as it attacks tea; the *Croton* cannot at present be regarded as the starting point of the disease. It would be of assistance if, when this disease has been identified on the estate, the planter would collect and forward all the fungi found on the jungle stump nearest to the diseased bushes, as well as some of its decaying roots. Every effort should be made to get rid of this disease in the new clearing; it has proved extremely difficult to eradicate in one instance, and has taken an annual toll of the bushes for several years.

It is well-known that the stumps of Grevilleas afford a starting point for our commonest tea root disease, caused by *Ustulina zonata*, and it is by no means rare to find groups of half a dozen dead tea bushes round a large percentage of these stumps on up-country estates. It has now been demonstrated that Albizzia stumps also become centres of the same disease; and where large Albizzias are felled a similar loss of tea bushes may be expected. This propagation of root disease is practically inevitable, so long as large trees which must be afterwards felled are planted among tea. In this respect Albizzias are worse than Grevilleas, because of the larger area occupied by the roots and base of the stem. The average Grevillea stump can be extracted with comparatively little labour, but one would hesitate before advising the extraction of Albizzia stumps. Of course, the decay of stumps is brought about by fungi in all cases, and it is a matter of chance whether the fungi which settle on any individual stump are harmless or injurious species. It is therefore quite possible to fell either Grevilleas or Albizzias without any subsequent development of root disease. But the risk must be borne in mind, and either tree should be up-rooted where practicable. Some day we may arrive at the conclusion that it is unwise to plant, among tea, species which will grow into huge trees which must be felled later, or at least that it is unwise to allow them to grow so large. It may be noted that the root disease which develops from Grevillea and Albizzia stumps has not been known to attack Hevea.

The original "canker" of Hevea has not been much in evidence during the last three or four years, but several cases were notified during the prolonged rainy season of this year, and the subject is being reinvestigated. It has been determined that in many cases, probably in the majority of cases, the death of the bark in patches after the tree has been scraped before tapping is due to "canker," sometimes assisted by deeper scraping than should be allowed. But the most general symptoms exhibited during the current year differ completely from those previously recorded. The disease attacked the renewing bark on the surface which was being tapped. The bark showed numerous vertical black lines, and on cutting it out these lines were found to extend into the wood. These black lines may be found on the cambium before they are evident externally. The bark round these lines decays, leaving a narrow vertical wound. Sometimes adjacent patches coalesce, and the whole of the renewing bark decays. In most cases the disease does not extend downwards as rapidly as the bark is excised during tapping, and it is therefore possible to continue tapping although the tree is diseased. With the advent of drier weather the disease stops and the bark renews over the wounds, but as it has to grow in from the edges of the vertical wounds, the renewed bark is rough. Except for this rough bark, there is no permanent injury to the tree.

The cause of Hevea canker cannot be said to have been determined. Four organisms have been found fairly regularly in the diseased tissue. Two of these are in all probability only saprophytic and are not being considered at present; the other two are a bacterium and a Nectria. The evidence of the diseased tissue seems to point to the bacterium as the cause, since it is always found in advance of the hyphæ of the Nectria, and the discolouration of the wood is identical with that in the bacterical cultures. But inoculations with both these organisms have so far been unsuccessful. The bacterium has been isolated and grown in pure cultures, but an attempt to produce "canker" by inoculating tapped surfaces with bacteria from these cultures has proved a failure up to the present. In the case of the Nectria, the ripe spores were caught as they were ejected from the fructification, and these were proved capable of germination by sowing them in culture solutions; but no success has yet followed the inoculation with these spores.

HORTICULTURE.

HOW TO TRANSPLANT A TREE.

By Harold Cuzner.

(From the *Philippine Agricultural Review*, Vol. II., No. 6, June, 1909.)

A tree should be transplanted at the period of its life when it is liable to receive the smallest possible injury. This, in this country, is as a general rule at the beginning of the rainy season; except in case the transplanting is to be done at the close of the rainy season before the soil begins to get dry.

If the trees are very young when transplanted they may be dug up carefully, taking care not to injure the roots, and set out where desired. If the trees are of large size it will be found that they will stand moving much better if the roots are pruned several months before taking them up. In large nurseries this is done by an L-shaped blade cf steel attached to a plough beam which is run along rather close to the trees cutting the roots, but when only a small number are to be handled the same thing may be accomplished by running a spade down on all sides of the young tree. After this has been done the trees should be left standing where they were growing and the cut surfaces will heal over and put out a number of new small roots which can be preserved when the tree is dug up later on, when it will be found to stand the transplanting with much less injury than if not so treated.

When trees are to be moved but a short distance, they may be taken up with large balls of earth adhering to their roots to prevent their drying out; if this is carefully done the tree will continue to grow without any apparent check.

When trees are to be shipped some distance, however, this becomes impracticable, and in this case the roots, as soon as the trees are dug up, should be immediately ploughed into a mixture of clay and water about the consistency of thick cream. This mixture is known as "puddle." It has the effect of coating the roots with a layer of mud that prevents the air from drying them out as rapidly as they otherwise would. The trees should then be packed closely in moist sphagnum or wet straw and sent as quickly as possible to their destination.

When the trees are received, if they have been shipped some distance, the bales should be opened at once and be "healed in," *i.e.*, set close together in a trench deep enough to take in the roots and part of the stem. This may be easily done by digging one trench and throwing all of the other soil on one side close to the trench. Then set in a row of trees close together and dig soil from the side of the trench opposite to that on which the soil was thrown to cover the roots. In this way a second trench will be formed parallel to the first which will be ready for a second row of trees. The trees should be moist and packed well around the roots, treading it down with the feet. If the trees look at all withered it would be well to have water thrown all over them. The site selected for "healing in" the trees should be well drained and accessible to the place where the permanent planting is to be made, so that they may be pulled out and set as fast as possible.

Before planting, any bruised or injured roots should be cut off with a sharp knife so as to leave a clean smooth surface that will heal over quickly. The cut should be made so that the cut surface will be facing downward rather than to the side or upward.

Some trees are very sensitive to transplanting and will not grow readily even though the above directions are followed. Among these is the *Cassia florida*, which often fails to grow even though the trees are not more than 5 feet tall, and are taken up with a ball of earth 18 inches in diameter, unless great care is taken not to break this ball of earth; while others, like the rain tree, will stand very rough handling.

It will be found, however, that for the great majority of trees the above method will give good results if the planting is well done. The holes must be dug in accordance with the size of the trees to be set out, but in no case should the holes be so small as to cramp the roots of the tree, and they should be deep enough to allow the tree to be set 1 or 2 inches deeper than it originally grew. The soil should be well worked in about the roots and packed firm, but not hard. However, the top layer of soil, to a depth of 2 or 3 inches, should be left loose to act as a mulch and prevent the loss of water from the surface by evaporation.

As a general rule one or two years' old seedlings will be found to be the best for transplanting, and older trees should be used only where for some reason it is necessary or urgent to secure results, as the expense of handling larger trees is considerable, and the chances of success are smaller.

APICULTURE.

THE COLOUR SENSE OF THE HONEY-BEE.

SOME ORIGINAL WORK SHOWING HOW THE BEES SEEM TO FAVOUR BLUE.

BY JOHN H. LOVELL.

(From the *Gleanings in Bee Culture*, Vol. XXXVII., No. 17, September 1, 1909.)

It has been well established by experiment that the honey-bee can distinguish between colours. Instead of describing the experiment as performed by Lord Avebury (Lubbock), let me give some that I conducted along the same plan, and, I am glad to say, with even more conclusive results.

On a pleasant September morning I accustomed a yellow (Italian) bee to visit a strip of blue paper three inches long by one inch wide. To prevent the paper from blowing away or becoming soiled it was covered with a transparent glass slide of the same dimensions, upon the centre of which a small quantity of honey was placed. These slides are used for mounting microscopic objects, and may be obtained of any dealer in optical instruments for a trifling sum.

After the bee had made a number of visits to the blue paper, a red slide of the same dimensions, and prepared as described above was placed six inches to the right of it. An equal quantity of honey was also placed upon the centre of the slide. When the bee returned from the hive it alighted on the blue slide, which still remained in its original position.

On the departure of the bee for the hive the slides were transposed, *i.e.*, the red put in the place of blue, and the blue where the red had been. When the bee returned, and no longer found the blue paper in its usual position, it flew back and forth, examining both slides, paused for a second or two on the red, then resumed its flight, but finally settled on the blue. A little later it flew up into the air, but soon returned to the blue; then it flew across to the red, where it remained for the rest of its visits. The change in the position of the blue, and the discovery of a differently coloured slide also bearing honey, evidently disturbed the bee; and its frequent flights showed that it was endeavouring to orient itself to these new conditions. As will now appear it did not find i necessary to repeat this course of reconnoitering.

While the bee was away I transpose the slides for a second time, the distance apart being as before—six inches. The bee returned directly to the blue. Twice it left the blue for a few moments, but each time returned to it.

When the bee left for the hive, I again transposed the slides; then the bee returned to the blue. The bee left for the hive, and I transposed the slides. It returned to the blue.

While the bee was away I transposed the slides for the fifth time. The bee returned to the blue. Then it left the blue slide, flew across to the red, but at once returned to the blue.

The bee left for the hive and I transposed the slides. On its return it circled about as though in doubt, and presently disappeared from view; but a little later it returned and settled on the blue. While taking up its load of honey it left the blue three times, but in each instance returned.

The bee left for the hive and I transposed the slides. It turned to the blue.

The bee left for the hive and I transposed the slides for the eighth time. On returning the bee hovered close to the red, and then went to the blue.

As soon as the bee returned to the hive, I transposed the slides for the ninth and last time. When the bee came back, it alighted after a little hesitation on the blue. It left once and flew across to the red, but soon returned to the blue. Left a second time but soon returned. Then it flew into the room, and on being released went back to the hive.

There can be no question that in this experiment the honey-bee was able to distinguish the blue colour from the red. It repeated the experiment many times and varied it in many different ways,

but the bee always showed its ability to distinguish between different colours. Only one bee should be employed, for if there are two or three they will conflict and to some extent produce confusion.

Lubbock also endeavoured to show that blue is the favourite colour of the honey-bee; but his results are unsatisfactory, and his method of exposition is obscure, and does not give sufficient details. Says Cowan in his book on the honey-bee, "The Experiments of Sir John Lubbock are not at all conclusive that bees have a preference for any particular colour." On the other hand, Hermann Müller, who was the greatest authority the world has ever produced on the mutual relations of insects and flowers, declared, after innumerable observations, that blue is more agreeable to the honey bee than any other colour. In his experiments he used flower-petals of different colours placed under grass slides, and he arranged the different colours in the following series according to the preference of the honey-bee: violet, blue, red, white, pale yellow, pure green, glaring red, and glaring yellow. Within the past ten years, however, Prof. Felix Plateau, of the University of Ghent, Belgium, has published many papers, in which he asserts that Müller was mislead by a too vivid imagination.

Now, does the honey-bee prefer blue to every other colour or not? Is Muller or Plateau right? During the past summer, for the purpose of answering these questions, I made many experiments with slips of coloured paper and with floral leaves, but the results were inconclusive. Apparently there is no doubt that a person dressed in black will receive a greater number of stings than one wearing white clothing. Do the bees see the black more readily than the white? or does black excite them in the same way that red enrages the bull or the turkey-gobbler? Strictly speaking, of course, neither black nor white is a colour.

I am now devising some new experiments to be tried another season, in the hope of deciding the matter one way or the other. I should like to ask the many readers of *Gleanings* two questions. 1. Have you ever observed any evidence to prove that the honey-bee prefers one colour (as blue) to another? 2. Can you suggest an experiment that will help in the solution of this problem? In either case will you kindly write and give me the benefit of your observations and suggestions? Let us remember that, in the multitude of counsellors, there is wisdom.

Waldoboro, Maine.

SCIENTIFIC AGRICULTURE.

THE ORGANISMS OF THE SOIL.

BY E. H. L. SCHWARZ, A.R.C.S., F.G.S., Rhodes University College, Grahamstown, South Africa.

(From the *Science Progress*, No. 13, July, 1909.)

To Liebig and the early investigators of the soil, the processes of decomposition which obviously take place in it were the results of purely chemical action. But the more the soil was investigated, the more this explanation became untenable. There was discovered in it a teeming race of animals, as well as of plants, of an order different from those which live upon the outer surface; a race of minute organisms distinguished in essential characters from the larger forms which had been thought to be the only tenants of the globe. In these dwarfs the living substance of those which had their being in Archæan times is alive to-day. Brought into existence to destroy, to break up the rocks of the primitive earth, to prey upon everything that came within their reach, many of them, when the earth became peopled with the higher animals and over-grown with the plants for which their activities had prepared the way, turned upon these usurpers and sought their annihilation. These microscopic beings of the underground world are the bacteria, moulds, fungi, blue-green, algæ, myxomycetes and the host of dreaded germs which plague us, our cattle and our crops.

The main work of these organisms, however, is not to cause disease in the higher animals and plants. The soil is not primarily a medium on which to grow trees and herbs, but is the domain in which bacteria and other lovely forms of life exert their activity, the higher plants exist by virtue of these, just as animals live by virtue of the herbage.

The lower organisms which live in the soil and belong to the vegetable kingdom are usually divided into the bacteria and true fungi, moulds, yeasts

and so on. The following estimates are given by Ramann of the relative proportions in the various types of soil* :—

Type of soil.	Bacteria in 1 grm. of dry substance.	Fungi in 1 grm. of dry substance.
1. Pines with beech undergrowth	35,000,000	60,000
2. Pines in boggy ground	1,647,000	343,000
3. Beech-leaf mould	31,000,000	560,000
4. Old leaf mould below No. 3	264,000	800,000
5. Leaf mould in oak coppice	40,000,000	3,430,000
6. Pine-needle mould	50,000,000	Uncountable
7. Loamy soil	4,860,000	4,000-277,000*a*
8. Sandy soil	2,500,000	66,000-566,000*a*
9. Soil below humus	247,000	35,000-350,000*a*

These numbers may seem enormous, but it must be remembered that the bacteria and spores are very small: a bacterium is about one-thousandth of a millimetre in diameter, and the "saturation" point in soil is only reached when there are six hundred million bacteria in a cubic centimetre.

The manner of estimating such germs is by growing cultures in nutrient gelatine and agar-agar, and then counting the developing colonies of bacteria; the results are approximate only, and there are doubtless many that do not germinate in the particular medium employed. Others again are too small to be recognised under the highest powers of the microscope. Another factor which increases the difficulties of estimation is the enormous powers of multiplication which these organisms possess: a bacterium divides into two every thirty-five minutes; one bacterium, therefore, at the end of twelve hours will have four million descendants, so that the numbers in the soil vary from moment to moment.

Whilst actual numbers cannot be given definitely, the proportions are more or less correct. It has been found that bacteria are more abundant in the first foot of soil.† Thus Adametz found in one gramme at the surface 38,000 bacteria, whilst at a depth of ten inches there were 460,000. In this particular sample there were only 40 to 50 fungus germs, of which six species were true moulds and four were ferments, including the yeasts of wine and beer. At three feet down the numbers decrease rapidly in proportion to the æration of the soil. Fraenckel, however, found that even in the soil beneath the pavement of Berlin there were still considerable numbers at a depth of eight to ten feet.*

Bacteria predominate in cultivated lands, whilst moulds are found in open meadow and in fresh soil. It is a function of the moulds to keep the surface layer open; they send their hyphæ between the grains of sand and particles of clay, push them aside and make channels for the entrance of air. They may be called Nature's tillers. In cultivated ground man ploughs and harrows the land, so that an artificial tilth is produced far in excess of that in natural soil, and crops grown on it are unable to thrive without hindrance; whereas if the same seed were planted in natural soil, just sufficiently ærated to support the indigenous flora, the germinating plants would be stifled.

The works of the moulds in another direction can be seen on pine-needle litter or fresh leaf litter, where the leaves are bound together by a web made by the tender filaments of growing moulds and decomposition goes on rapidly. Rostrup† called this particular form of mould *Clodosporium humifaciens*, but there are doubtless many kinds at work, all active in breaking down the cellulose of plants into humus. It is this parasitic and saprophytic action of the lower organisms that has overshadowed the importance of their other less obvious activities. Many species are certainly specially fitted to promote fermentation, putrefaction, decay in all its forms in vegetable and animal tissues, but some have other work to do. Kunze has shown that the higher plants have roots that are incapable of breaking down the mineral substances which they absorb, and Kunze attributes the assimilation of these to the work of bacteria and moulds,‡ Nikitinsky,§ Czapek and Kohn‖ have shown that cultures of the moulds *Aspergillus niger* and *Penicillium glacum*, when fed with ammonium chloride, set free hydrochloric acid, which alone or in the presence of nitrates is capable of dissolving most of the known mineral substances. It is not impossible, therefore, as has been assumed, that the precipitation of gold in the hot water of the Steamboat Spring of Nevada is brought about by the action of

* E. Ramann, Bodekunde, Berlin, 1909, p. 120.
† Adametz, *Inaug. Diss.* Leipzig, 1876.
a From one cubic centimetre.

* Fraenckel, *Zeitschr: f. Hygiene*, Vol. ii. p. 521.
† E. Ramann, *loc. cit.* p. 119.
‡ G. Kunze, *Jahrbuch, wiss. Bot.* Vol. xlii; 1906, p. 357.
§ J. Nikitinsky, *Jahrbuch, wiss. Bot.* Vol. xl. 1904. p. 1.
‖ F. Czapek and E. Kohn, *Hofmeist. Beitrage z. Chem. Phys.* Vol. vii. 1906, p. 302; F. Czapek, *Progressus reibotanicoc, Jena,* 1907, p. 436.

plants much in the way in which Cohn has shown, calcium carbonate is deposited in the Sprudelstein of Carlsbad.*

Bacteria have been studied principally from the standpoint of disease in man and animals, but recently the attention of agriculturists has been directed to the nitrifying organisms. The first step in fixation of atmospheric nitrogen is accomplished by certain flagellate cells called *Nitrosomonas*, belonging probably to the animal kingdom; these are succeeded by minute rod-like bacteria called *Nitrobacteria*, which oxidise the product of the former into nitrates. These latter live principally, or perhaps more properly should be described as having been detected living in the root nodules of clover, peas and similar leguminosæ, and have been called *Rhizobium leguminosum;* they are occasionally found on the roots of forest trees, and it is now recognised that bacteria with similar functions live free in the soil. Another nitrifying organism is the *Azotobacter chroococcus*, which lives on the leaves or trees, and causes leaf mould to be so rich in nitrogenous compounds.† Some of the bacteria and some of the ferments also have the power of undoing the work of these nitrifying bacteria; they denitrify and liberate nitrogen from nitrates. The fact is familiar to gardeners in the case of fresh stable manure, where the action is brought about by denitrifying bacteria, whereas from rotted manure the deleterious organisms are absent.‡

Regarding the action of the blue-green algæ in forming soil Fritsch has accumulated a large amount of information.§ In a large tank at Nalande in Ceylon the first forms to secure a foothold on the bare rock were found to be red-coloured gelatinous species of the genera *Glœocapsa* and *Aphanocapas*; then, when a resting-place is secured, an adhesive species, *Phormidium laminosum*, grows upon it, covering large portions of the rock surface with huge thin papery films. Tangled filaments of *Scytonema* develop out of the Phormidium, and tufts of Tolypothrix succeed these. Treub, who visited Krakatoa after the eruption of 1883, found the ground covered with a thin, gelatinous, hygroscopic layer of blue-green algæ of which the genera *Tolypothrix*, *Anabœna*, *Symploca*, and *Lyngbya* were the first to appear on the bare rock. These growing on the volcanic ash and pumice, of which the whole island was composed, gradually formed a soil on which higher plants could grow.*

Welwitsch describes a similar growth of algæ on the "Black Rocks" of Pungo Andongo, in Angola. These black rocks owe their colour to the abundant growth of a sub-ærial alga, *Scytonema myochrous* var. *chorographicum*, which generates and multiplies so rapidly during the rainy season that the upper portions of the mountains are covered with it in a very short while. Soon after the hot season has set in, at the end of May, the black plantlets begin to be discoloured by the intense heat. They gradually become dry and brittle, until they peel off entirely by-and-by, after which the rocks loose their sombre aspect and reappear a their natural grey-brown colour.† Bohlin had described four algæ in the Azores living on the volcanic rocks in a similar way.‡

The blue-green algæ are, however, semi-aquatic, and they can only live in moist places; when, however, they are joined with a fungus symbiotically to form a lichen, the weft of the mycelium of the fungus protects them sufficiently from desiccation, and the blue-green algæ are rendered practically independent of moisture. Welwitsch describes how in the sandy valley of Cuanza River, in Angola, a Blue-green alga, *Porphyrosiphon notarisii* extends over wide meadows. By reason of its hygroscopic nature, it absorbs the atmospheric moisture during the dewy nights, affording by this means a refreshing protection to the roots of the larger plants during glowing heat of the day. Boodle has described a more vigorous

* *F.* Cohn, *Neues Jahrab.* 1863, p. 580; see also W. H. Weed. The formation of. Hot-Spring Deposits, *Internat. Congr. Geol, Gompte, Rendu*, 5th Sess. 1898, p. 360.

† A. D. Hall, Recent Developments in Agricultural Science, *Addresses and Papers, British and South Africa Association Advancing Science. Johannesburg*, 1905, Vol. i. p. 103.

‡ R. Burri and A. Stutzer, *Centr. f. Bakt.* (2), Vol. i. 1895, p. 442

§ F. E. Fritsch, The Rôle of the Algal Growth in the Colonisation of New Ground, Geogr. Journal, Vol. xxx. 1907, p. 531.

* M. Treub, Notice sur la nouvelle Flore de Krakatoa, *Ann. Jard. Bot. Buitenzorg*, Vol. vii. 1888, p. 213; see also Penzig, *lot ci.* Vol. xviii. 1902, p. 92.

† F. Welwitsch, *Journ. of Travel an Nat. Hist.* Vol. I. i. 1868; see also Apontamentos Phyto-Geographicos solve a flora da provincia de Angola, etc., *Annaesdo Conselho Ultramarino*, Parte nao off, Ser. i. Dez 1858. p, 533; also E. Tenzl, Bericht über einige der wichti Ergebnisse der Bereisung der Portugiesischen Kolonie von Angola in den Jahren 1850-1860 durch Dr. F. Welwitsch, Vienna, 1864.

‡ F. Bohlin, Etude sur la Flore algologique d'eau douce des Acores, Bib. K. Svenska vet. Ak. Handl. Vol. xxvii, Afd. iii. No. 1 p.

growth in the deserts of Australia, where the dried algæ form a crust resembling elastic bitumen on the surface.*

In all these cases the algæ and lichens do not merely cling to the rock surface; they definitely eat and digest the rocks on which they grow, as may be seen by the corrosion of the surface, and also by the presence of the substances in the rock in the cells of the plants in the form of crystals of oxalate of lime and so forth.

The investigation of the microscopic animals of the soil is practically untouched. Müller found *Difflugia*, a large freshwater rhizopod, in bog humus† and I have mentioned the case of *Nitrosomonas.* The intestines of earthworms swarm with gregarines, which seem to play the same part in them as bacteria do in the case of plants. In tan pits the *Fuligo varians* (Æthalium septicum), commonly known as "flowers of tan," spreads out in colonies a foot or more in diameter; the germs of this organism must exist in the natural bark and in the soil of forests.

It is a legitimate question to ask, "What do the bacteria and other organisms in the soil do when all decomposition possible has been accomplished"? We have seen what teeming myraids live in the soil. We know that if the soil is treated with weak solutions of carbolic acid and mercury chloride, which kill bacteria, the soil is rendered sterile. We shall now proceed to show that bacteria are known to act directly on inorganic substances, and the inference seems to follow naturally that a large part of the activities of the micro-organisms in the soil is concerned with the breaking down of rock substances.

The absorption of carbonate of lime by the lower organisms is well known, In plants the minute coccoliths and rhabdolths, the blue-green algæ, *Chroococcus* and *Glœocapsa*, the larger red or calcareous seaweeds, are examples, whilst among animals all the protozoa and some sponges absorb and secrete carbonate of lime as one of the functions of the activities of their cells. The action is perfectly simple: by the oxidation of the carbon in their protoplasm carbon dioxide is produced, which acts on calcium carbonate and forms a soluble compound. The formation of oolite grains is another instance: the collection of the carbonate of lime is supposed to be brought about by the thallus of an alga, which encrusts the central grain, depositing calcium carbonate in concentric layers as it grows. Certainly the encrusting red algæ act in the same way, but living organism has never been observed on the oolite grains, though nodules of carbonate of lime in fresh-water lakes are usually covered with blue-green algæ, *Glœocapsa*, etc. The same process is believed to give rise to the pisolites which separate in pea-like granules as deposits from hot springs. The blue-green algæ can live in hot water, but the actual organisms on the pisolites have not been seen, though Cohn asserts their presence.

On the other hand, the destruction of oolite grains and shells generally is accomplished by boring algæ, such as Hyella,* which send their microscopic filaments through and through the hard calcite similarly to the mycelia of a fungus penetrating rotten wood; Lind,† in fact, found that fungi were actually capable of sending their hyphæ through marble. Boring sponges like Cliona do the same.‡

The separation of silica cannot be so easily explained. There are countless plants and animals which absorb and secrete silica, and the lower forms are usually closely allied to the lime-secreting genera. Among the silicious plants there are the hosts of diatoms, and among animals the radiolaria and sponges.

In the case of iron again, there are differences of opinion. The bog-iron which forms at the bottom of lakes and under the soil in marshy places, where it is known as moor-bed-stone, ortstein or oude klip, is thought to be the result of chemical deposition. Organic acids certainly dissolve the iron, and when the solution is oxygenated, carbon dioxide is given off and the iron is deposited either as a carbonate or as a hydrate. This is what happens in the laboratory; in Nature, however, the precipitation goes on in the bottoms of lakes and in soil which is not properly ærated. Ehrenberg attributed the deposition to a diatom which he called *Gallionable ferruginea.*§

* L. A. Boodl , *Bull. Miscellaneous Inf. Kew*-No. 5, 1907, p. 145; see also W. T. Thiselton Dyer, Australian *Caoutchouc, Journ. Bot.* New Ser. Vol. i. 1872, p. 103.

† P. E. Müller, *Naturliche Humusformen*, Berlin, p. 27.

* E. Bornet et Flahault, Note sur duex nouveaux genres *d'* algues perforantes, *Jour. Bot.* vol. ii. 1888, p. 161; see also J. E. Duerden, Boring Algæ, *Bull.* ANN. *Mus. Nat. Hist.* New York, Vol. xvi. 1902, p. 323.

† K. Lind, Jahrbüch. Wiss. Bot Bd. xxxii. 1898, p. 603.

‡ Topsent, *Arch. Zool. Exper.* (3), Vol. viii 1900, p. 226.

§ C. G. Ehrenberg, *Mikrogeologie*, Leipzig, 1854.

When we come to the sulphate the evidence is clearer. There are definite bacteria which feed on sulphur and separate in both in the form of oily globules of the element and as sulphurreted hydrogen. The effect of feeding the bacteria of the soil with gypsum (hydrated sulphate of lime) is most marked. Pichard states the fact in the following way: the nitrification in the soil by bacteria is stimulated by:—

Magnesium carbonate	12·5	times proportionately *
Calcium carbonate	13·3	,, ,,
Potassium sulphate	35·8	,, ,,
Sodium sulphate	47·9	,, ,,
Gypsum	100·0	,, ,,

In the case of the carbonates the action is probably simply due to the neutralisation of acids which act deleteriously on bacteria; but actions of sulphates is certainly direct and is due to their forming food-stuff for the organisms.

Though no direct evidence is as yet available as to the action of sulphur bacteria in the soil, there are the researches of Zelinsky and Brussilovsky on the bacteria in the Black Sea, which leave very little doubt that the reaction on land is a similar one to that in the sea. The surface waters of the Black Sea contain free oxygen and support an abundance of organic life; but the deeper and denser waters are charged with sulphuretted hydrogen, and the only organisms present are the bacteria. The amount of sulpheretted hydrogen increases with depth. At 100 fathoms there are 33 cubic centimetres in 100 litres; at 200 fathoms, 222 c.c., and at 1185 fathoms, 655 c.c. Several species of bacteria have been observed, but only one, the *Bacterium hydrosulphuricum ponticum*, has been studied in detail. This bacterium possesses the power of liberating sulphuretted hydrogen, not only from organic matter containing sulphur, but also directly from sulphates and sulphites. All authors are agreed that the sulphates of the sea-water are acted upon, but there is some divergence of views as to whether the changes are due solely to bacteria, or whether they are in part purely chemical. Changes of an opposite kind take place in the zone where water containing sulphuretted hydrogen comes into contact with that containing oxygen. This zone occurs at a depth of about 200 fathoms. According to Yegunov and Vinogradski, there is at this depth a race of sulphur bacteria which derive the energy necessary for their existence from the sulphur of the sulphuretted hydrogen. This sulphuretted hydrogen is separated in their cells in the form of soft, oily globules, and the oxidation of this sulphur gives them the necessary vital energy in precisely the same manner as the oxidation of carbon in other organisms supplies it. I must express my indebtedness to the presidential address to the Geological Society by Dr. Teall for the above facts, especially as it has led to the train of reasoning adopted in the present article.*

The organic substance of plants and animals, the protoplasm, consists essentially of carbon, hydrogen, oxygen, nitrogen, sulphur and phosphorus. We have dealt with the separation of all these by micro-organisms except the last. We know of no phosphorus-eating bacteria, but phosphorus exists plentifully in the soil, being derived from the mineral apatite, a calcium phosphate, which is an accessory mineral in all igneous rocks. The natural phosphates of lime and magnesia are readily soluble in all weak acids and are available directly to the plant roots; but if there is any hydrated oxide of iron present in the soil, there is formed a phosphate of iron which is totally insoluble. Basic slag, for instance, which contains large quantities of phosphorus and iron, lies unaltered on fields with damp soil showing an acid reaction. As previously stated, Kunze has proved that in many of the higher plants the roots do not secrete organic acids, the only secretion being water containing carbon dioxide. Prianischnikoff found that on growing peas, lupines, mustard and buckwheat, in sand containing aluminum phosphate, which, like phosphate of iron, is insoluble in carbonic acid, there was a vigorous absorption of the phosphates by the plants, and the conclusion he arrived at was that the breaking down of the insoluble substances had been accomplished by bacteria.†

In South Africa the central parts of the country are dry; along the river courses there are magnificent stretches of alluvium, which, however, can only be occasionally watered by floods or artificial irrigation. The soil is usually rich in phosphate, but on taking samples of the soil after a spell of drought they are found to be in the insoluble form. When, however, the fields are watered and brought under cultivation, then on analysis the soil shows a high percentage of soluble phosphates. There may be other means of explaining this phenomenon, but the one which sug-

* E. W. Hilgard, *Soils in Humid and Arid Regions*, New York, 1906, p. 147.

* J. J. H. Teall, *Quart. Journ. Geol. Soc.*, Vol lviii. p. lxvii.

† D. Prianischnikoff, *Bericht. deutsch. bot. Ges.* Vol. xxii. 1904, p. 184.

gests itself to any one acquainted with bacteria in the soil and their life history is that the solubility of the phosphates is brought about by the action of bacteria. When the soil becomes dry and parched the bacteria encyst or retire into minute horny capsules, and their activities cease; when water is supplied to them, the capsules absorb water and burst, freeing the rested organisms, which straightway start propagating at the very rapid rate observed in such organisms.

This explanation is founded on analogy; but then similar analogies have been proved to be actual facts in the cases of carbon, nitrogen and sulphur, and it is likely to prove so, judging from Prianischnikoff's experiments, in the case of the last essential constituent to protoplasm. If it be so, then it is one of the most beautiful examples of the manner in which Nature preserves her most precious assets against the proper time.

We come then to regard the organisms of the soil as the inhabitants of the globe persisting from a period when it was still impossible for the higher plants and animals to live upon it. We can imagine the earth to have been in such a state as Treub found the island of Krakatoa in 1886, three years after the great eruption, when the primitive rocks were teeming with microscopic life. In Krakatoa the whole island had been reduced to a mass of glowing ash; but still, after a short interval, the surface became slimy with micro-organisms busily breaking down the silicates and forming a subsoil which the higher plants, later on, would take advantage of. In the early history of the earth the soil became similarly formed, but æons of time had to pass before the higher plants became developed and were able to take advantage of the habitat prepared for them. Heat, which kills most living beings, was no hindrance, for the blue-green algæ live in nearly boiling water to-day in the hot springs;* food, as we understand it, these organisms did not require, as they obtained their supplies directly from the rocks. We can assert that plants originally formed, collecting their carbon, hydrogen, oxygen, nitrogen and phosphorous from the inorganic substances around them and then, with their oily secretions forming emulsions with water, creating, as Butschli has suggested, the primitive animals which were to devour them. It is to the soil that we should look as the seat of the origin or organic life, not the sea.

* As far as I can discover the highest recorded temperature is 85° C.: A. Engler and K. Prantl, *Die Nat. Pflauzenfam*, 1. Teil, Leipzig, 1900, p. 63.

EXPERIMENTS ON THE VALUE OF NITRO-BACTERINE.

BY C. T. GINNINGHAM,
Bacteriologist to the S. E. Agricultural College, Wye, Kent.

(From the *Gardeners' Chronicle*, Vol. XLV., No. 1, 152, January, 1909.)

In the spring of this year a culture material known as "Nitro-bacterine," for introducing into the soil those valuable bacteria which form nodules on the roots of leguminous plants was largely advertised. Its value and efficiency, at least with garden crops, have now been scientifically tested in a number of cases with almost uniformly unfavourable results. I would refer to the very complete series of experiments carried out on the inoculation of Peas with "Nitro-bacterine" by Mr. F. J. Chittenden, F.L.S., at the Royal Horticultural Society's gardens at Wisley (J.R.H.S., Vol. 34, part II., November, 1908). The following sentences occur in his summary:—"There was under no soil treatment a consistent increase in the crop due to inoculation. The uninoculated seed gave a crop 14 per cent. heavier than the inoculated in the aggregate. It is concluded that the inoculation of leguminous crops with "Nitro-bacterine" in *ordinary garden soil* is not likely to prove beneficial." Dr. Voelcker also has given the material a trial at the Royal Agricultural Society's farm at Woburn, with results in no wise favourable to "Nitro-bacterine," and there is a mass of private testimony to the same effect.

In these circumstances it will perhaps be of interest if I briefly record the results of an experiment on the inoculation of Peas and Beans with "Nitro-bacterine" at the S. E. Agricultural College, Wye, Kent, which add further confirmation to these conclusions.

The varieties of Peas employed were Carter's "Eight Weeks," "Early Morn" and "Yorkshire Hero." Two sets of trials were carried out (1) on very poor soil just above the chalk, and merely dug over before sowing; (2) on well-manured trenched ground intended for vegetable culture. Four rows of each variety—each row 21 feet long—were planted, and in each case a row sown with inoculated seed alternated with a

row sown with untreated seed. The preparation of the culture material and the inoculation of the seed were performed precisely according to the instructions given, and, in all details, inoculated and uninoculated rows were treated in an identical manner.

The following table gives the results, showing the total weight of pods obtained from each pair of rows, expressed in grams.

SOIL MANURED AND TRENCHED.

Variety.	Seed not Inoculated. Grams.	Seed Inoculated. Grams.
Early Morn ...	9,889	8,010
Yorkshire Hero ...	14,780	14,295
Broad Beans ...	13,142	12,091

POOR SOIL UNMANURED.

Variety.	Seed not Inoculated. Grams.	Seed Inoculated. Grams.
Eight Weeks ...	6,126	6,490
Early Morn ...	5,694	5,291
Yorkshire Hero ...	11,760	11,097
Broad Beans ...	10,427	9,098

The "Eight Weeks" Peas on the good soil were somewhat damaged by pigeons, and the crop was not weighed. It will be seen that the produce from the inoculated rows in every case but one weighed less than that from the corresponding uninoculated rows. Throughout the growth of the plants no difference between treated and untreated rows was distinguishable; both lots formed nodules on their roots to about the same extent, and the untreated rows came to maturity quite as soon as the others. There was no evidence of any kind to show that the slightest benefit had been obtained by the use of "Nitro-bacterine" on either type of soil.

The experiment was on a small scale, but so far as it goes, is conclusive, and serves to confirm many results obtained with "Nitro-bacterine" this summer. Further trials on a larger scale on a "seeds" mixture are in progress on the College farm.

BY FRED J. CHITTENDEN, F.L.S.,
Director, R. H. S. Laboratory, Wisley.

(From the *Gardeners' Chronicle* XLV., No. 1153, January, 1909.)

In the interesting comments in the *Gardeners' Chronicle* of January 9 and 16, upon the experiments carried out at the Royal Horticultural Society's Garden at Wisley, upon the value of nitro-bacterine in garden soil, attention is particularly directed to the remarkable fact that, in many cases, the produce from the plots which had received inoculated seeds was less than that from the plots which had received uninoculated seeds, but which had otherwise been similarly treated.

It should be pointed that an error has crept into one of the paragraphs in the summary of the report bearing upon this point. The error makes the difference appear materially greater than it actually was. The yield from the whole of the plots receiving inoculated seed was 495 lbs. (not 450 lbs.), while the total from the plots in which uninoculated seed was sown was 515 lbs. The uninoculated seed, therefore, gave a crop 4 per cent. (not 14 per cent.) heavier than the inoculated. The weights are correctly given in the body of the report, but the error appears in the "Summary," from which quotations are made.

Perhaps the most remarkable part of the result, however, lies in the fact that 31 rows out of the 48 which were sown with inoculated seed gave a smaller crop than the corresponding rows sown with uninoculated seed. It is suggested that it would be interesting to see how far and in what direction the average yield of the plants which had been inoculated varied from that of the uninoculated. The details concerning this point are already in the press, and will appear in the *Journal* of the Society shortly to be issued, along with some other details bearing upon the use of nitro-bacterine.

Unfortunately, the figures relating to the numbers of plants in the rows of two of the varieties were accidentally lost; but we have those relating to the other two varieties used in 48 rows, the seed in 24 of which was inoculated, and in 24 not. For details as to the number of plants in the separate rows, reference may be made to the forthcoming report, but the main results may here be noted. In six rows of the Ne Plus Ultra, in cultivated ground, grown from uninoculated seed, there were 353 plants which bore fruit, yielding, on an average, 98·7 grammes of pods. In the corresponding six rows, which were grown from inoculated seed, there were 384 plants, which yielded an average of 89·2 grammes of pods. Thus the average yield of the inoculated plants was 10 per cent. below that of the uninoculated, and four out of the six rows showed a decrease. In the six, uninoculated rows of the variety Maincrop, on the same soil, there were 266 plants, which bore an average of 110·5 grammes, and in the corresponding, ino-

culated rows, 240 plants giving an average of 103·9 grammes. Here, again, there is a diminished average yield of 6 per cent. from the inoculated plants, and four out of the six rows showed a decrease. On the fallow ground, six uninoculated rows of Ne Plus Ultra contained 297 plants, giving an average of 82·5 grames to the plant, and the six corresponding inoculated rows contained 291 plants, and gave an average of 80·8 grammes. In this case there was a diminished average yield of 3 per cent. from the inoculated plants, and four out of the six rows showed a lower average than the uninoculated.

The six, uninoculated rows of Maincrop, on the same soil, contained 266 plants, which gave an average of 52·5 grammes; while the inoculated rows contained 204 plants, and gave an average of 61·7 grammes to the plant. In this variety, therefore, there was an average increase of 17 per cent. from the inoculated plants, but only three out of the six rows showed an increase.

In all, out of 24 rows of inoculated seed, only seven produced a greater average yield than the corresponding uninoculated rows, and there was one giving an equal yield.

Like many other experiments of this nature, this has suggested the desirability of further investigation. The results obtained are far from showing that the decreased yield in these many cases is actually due to the inoculation with nitro-bacterine; but the results given in the report certainly suggest the question whether certain races of Pseudomonas radicicola may not induce a smaller yield than that obtained when the races of Pseudomonas native to a particular soil are present therein, and the results outlined above emphasise this question, and, at the same time, give a very interesting corroboration of the results, upon which the conclusion that "the inoculation of leguminous crops with nitro-bacterine in *ordinary garden soil*, is not likely to prove beneficial" was primarily based.

Finally, it should be emphasised that the experiment and the conclusion refer only to *ordinary garden soil*, and do not in any way show what may or may not be the result of using nitro-bacterine on newly-reclaimed land when such is brought under cultivation by means of leguminous crops.

MISCELLANEOUS.

PERSONAL NOTE.

(From "*Science*," October 15, 1909.)

On the occasion of the inauguration of Dr. A. Lawrence Lowell as President of Harvard University, honorary degrees were conferred on thirty delegates. Those on whom the degree of Doctor of Science were conferred and the characterizations of President Lowell were as follows:—

* * * * * *

John Christopher Willis, also a delegate from the University of Cambridge; an eminent botanist, remarkable for his knowledge of tropical vegetation; Director of the Royal Botanic Gardens in Ceylon; who has done a great work in improving the varieties useful to man.

and p. 520,

Dr. John C. Willis, Director of the Royal Botanic Gardens of Ceylon, will give a course of four lectures on "Tropical Agriculture, with special reference to Economic Problems," at Harvard University on October, 12, 14, 16, and 19.

LITERATURE OF ECONOMIC BOTANY AND AGRICULTURE,

By J. C. WILLIS.

Cowpea :—

Cowpeas. Nielson. U. S. Dept. of Agri. Bull. B. P. I., "T.A." Sept. 1908, p. 249, Oct. 1908, p. 351.

Cowpeas. Journ. Agric. Vict. 6, 1908, p. 652.

Cowpeas and Velvet Beans for Green Manuring. Agric. News. Nov. 1908, p. 375.

Cowpeas. Lieut.-Col. J. R. Y. Goldstein. "T.A." Feb. 1909, p. 133.

Crotalaria :—

Crotalaria juncea. Agr. Ledger, Indust. Series, 5, 1906.

Sunnhemp (Crotalaria Juncea) Dept. of Agri. Madras, III. 59, 1908.

Filets de pêche en Crotalaria. Journ. d' Agr. trop., Feb. 1909, p. 64.

Culture du Crotalaria dans l'Inde. Journ. d' Agric. Trop., June 1909, p. 179.

Croton :—

Note on Croton aromaticus var. lacciferum. Drieberg and Bamber. "T.A." July 1907, p. 21.

Cuscuta.—The love vine. Agri. News, 31. 10. 1908, p. 350.

Cytisus :

Die Kultur der Tagasaste (C. proliferus var. palmensis). Mitth. Amani 27. 18, 6. 1904.

Daemonorops :—

East Indian dragon's blood. Kew Bull. 1906, p. 197.

Note on the method of preparing. Str. Bull. 1906, p. 264.

Date :—

Date varieties and date culture in Tunis. Bull. B. P. I., U. S. Dept. of Agri., 92, 1906.

The date palm. Agr. Ledger, V. P. Series 93, 1906.

The date palm. Agr. Gaz. N. S. W., 1907, p. 117.

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THE VALUE OF INDIAN CROPS.

(From the *Indian Trade Journal*, Vol. XIV., No. 176, August 12, 1909.)

It is in any country hard to ascertain exactly the area under the several crops and harder to estimate the total outturn to be derived from each. But a computation of the monetary value of such produce is a still more difficult matter. It may be possible in a small country, the division of whose cultivated areas is ascertainable with certainty, whose climatic conditions are so uniform that all the crops are reaped within a period of a few months, and in which the range of prices is narrow and accurately recorded. But in large tracts where these conditions do not exist, where the areas under the several crops are vast and uncertain, where the crops are reaped at widely different seasons, and where prices for all descriptions of produce are not adequately recorded on a uniform system, the work becomes so conjectural as to have small value of an absolute kind.

Even in the United States, where there is a large and intelligent body of private persons, farmers and others, who co-operate with the Department of Agriculture in reporting the various data required, and whose interests are in the main concerned in their accurate record, the wide range of crop seasons and of farm values suggests doubts as to the intrinsic usefulness of the published estimates of total value of the agricultural produce obtained.

In India such an estimate is not feasible, even if it were considered that it would be instructive. It is not at all certain that the returns of cultivated areas and of the principal crops are less accurate in India than in other countries; but there are a number of minor crops recorded under generic headings, and whose varieties, though they may have money values substantially different, are not distinguished in the statistics. In respect of others no estimate of outturn is attempted, while the mere areas under a further class of crops are lumped together. Moreover, there are at least two distinct harvest seasons in India: for monsoon crops and for cold weather crops respectively; and in the several tracts the incidence of the monsoon and of the hot weather that occasions the ripening of winter crops varies so greatly in point of time that a further dfficulty arises. The conventional year adopted in India for purposes statistical and dependent on statistics runs from April to March. It was adopted in order that it should include the seasons at which the summer and winter crops dependent on the rains of a given year are reaped. But it does not do so altogether. In some cases the harvesting of that portion of a given crop which is grown in Northern India is not begun before the end of the statistical year in which the more southerly portion of the same crop has been garnered and in part exported. All influences tend to shipment of produce as soon as it becomes available; so that the appearance of a commodity in the export movement may, in the absence of any other index, be accepted as defining roughly the time when it comes on the market. Wheat may be cited as an example. In the northern Punjab this crop is not cut before the end of April or beginning of May; but in Bombay and the Central Provinces reaping is begun in March, or even February, and in a favourable year considerable shipments might go forward before the end of March. But most of the exports are made in the subsequent statistical year. This to a much less extent holds good of oilseeds. In the case of cotton the heaviest shipments are made in the end of the statistical year in which the crop is produced, although large quantities remain for exportation in later months. It is therefore

necessary, when attempting any valuation of a crop, to decide somewhat arbitrarily, and on the merits of the particular case, whether the valuation is to be based on the prices current in the year of harvest or on those of the following year. It is found on study of the statistics of exportation that, of the crops for which forcasts are prepared, cotton, jute, rice, sesamum, groundnut and tea are exported mainly in the years in which they are produced, while wheat, linseed and rape and mustard are mainly exported in the following year. Therefore any estimate of the value of crops in the former group should be based on the prices of the year of cultivation, while those in the latter group must be valued on the prices of the next year.

But in India the mere establishment of the prices to be used in any one year is a matter of difficulty. It is comparatively easy to ascertain the average declared values of exports. But in India there are no export duties except on rice and rice flour. Where no export duties exist, there is commonly no great strictness in ascertaining the correctness of declared values. These are consequently not very reliable as a basis of valuation, Moreover, it has been recently shown in respect of wheat that the internal price at harvest time is lower than in later months—the reason being that cultivators are obliged to realise a part of their produce to meet the demand for rent and for payments in respect of loans. The export season terminates not so much because of the termination of demand for export as because of the gradual rise of the internal price beyond export level as soon as the immediate monetary requirements have been satisfied. It follows that export values are substantially lower than the average internal prices; and since the exports of wheat represent from one-eighth to one-seventh of the total crop, it would be quite unsound to value the residual seven-eighths or six-sevenths on the relatively low declared values of the exports. The same considerations apply to other forms of produce in varying degree; so it is clear that in selecting a basis of calcualation internal prices must be preferred to declared values.

A fortnightly record of wholesale internal prices is available in India in respect of all but one of those crops for which forecasts are published. The exception is groundnuts. Therefore internal prices are mainly relied on in the following calculations, but the value of the groundnut crop is estimated on the basis of the export values.

It will at once be objected that an export value is not admissible even in a single case, seeing that such value is commonly swelled by transport and trading charges. This is true; but it will be seen later on that there are sundry gaps in the data available regarding Indian crops as a whole, and that the deductions to be drawn from the calculations now attempted must be confined to a particular point which will not be to any material degree affected by the use of export values in the case of a commodity of which so arge a proportion is shipped.

By any one who brings, to the examination of the statements below, a certain knowledge of Indian conditions it will also be objected that there are some other crops not included, although returns of acreage are available in respect of them. The objection is good, but the absence of any annual estimates of outturn for these crops excludes them absolutely, and it is their exclusion that prevents any estimation of the total value of Indian agricultural produce.

Since then it is impossible to arrive at any estimate of the total value of Indian produce with such accuracy as to serve any practical purpose. it might seem useless to carry out a partial valuation. So far as any single year is concerned it would be useless to do so; but when the calculation is made for successive years certain interesting facts are disclosed in comparison.

Anything that bears upon prices in India has interest at the present time. The extent to which shortage of crops in recent years is responsible for the rise in Indian prices is indeterminate. But it is known that as a general rule shortage of crop is accompanied by a rise of price; and it is interesting to ascertain how far the rise of price compensates the producer for the reduction in the outturn. It is conceivable that as regards some monopoly crop in great demand the handling of a small quantity at enhanced rates might be more profitable than the handling of a large quantity at lower rates. But as a general rule we should scarcely expect to find a contraction of outturn otherwise than injurious to the cultivator—altogether apart from the fact that a very substantial portion of his outturn has to go in forced sale at low rates for the payment of rent and interest.

All we can hope to do, therefore, is to examine the facts relating to those crops for which stiatistics are available, and to ascertain how far these facts

point to any law of compensation probably operative in respect of all crops.

We append two statements showing the estimated outturn, the price and the value of each of these crops in the last years :—

Statement I.

1907—08.

Crop and Season.	Total estimated outturn.	Average wholesale rate.	Total value.
		Rs. Per 10 maunds.	Rs.
Cotton 1907-08 bales	3,122,000	187·91 =93·95 per bale.	29,33,27,510
Jute 1907 bales	9,817,800	74·05 =37·02 per bale.	36,35,04,045
Wheat 1906-07 tons	8,491,700	34·29 =93·34 per ton.	79,25,93,030
Rice 1907-08 tons	18,960,565	45·2 =123·03 per ton.	2,33,28,01,738
Linseed 1906-07 tons	425,200	51·19 =139·34 per ton.	5,92,47,[illegible]19
Rape & mustard 1906-07 tons	1,053,100	54·92 =149·49 per ton.	15,74,30,278
Sesamum 1907-08 tons	280,300	76·4 =207·96 per ton.	5,82,91,412
*Groundnut 1907-08 tons	352,500	*154·7 per ton.	5,45,31,750
Tea 1907 lbs	248,020,398	4·67 per lb.	10,33,50,100
		Total ...	4,21,50,76,882

* Declared value.

Statement II.

1908—09.

Crop and Season.	Total estimated outturn.	Average wholesale rate.	Total value.	Increase or Decrease as compared with previous year.
		Rs. Per 10 maunds	Rs.	Per cent.
Cotton 1908-09 bales	3,643,000	188·17 =94·08 per bale.	34,27,51,655	+16·8
Jute 1908 bales	6,310,800	53·15 =26·57 per bale.	16,77,09,510	—53·8
Wheat 1907-08 tons	6,104,200	37·53 =102·16 per ton.	62,35,84,684	—21·3
Rice 1908-09 tons	19,945,490	49·22 =133·98 per ton.	2,67,22,33,722	+14·6
Linseed 1907-08 tons	163,500	52·74 =143·56 per ton.	2,34,71,779	—60·3
Rape & mustard 1907-08 tons	688,000	58·53 =159·32 per ton.	10,96,11,238	—30·4
Sesamum 1908-09 tons	492,900	78·87 =214·68 per ton,	10,58,17,813	+8·15
*Groundnut 1908-09 tons	442,000	*151·6 per ton.	6,70,07,200	+22·9
Tea 1908 lbs	247,476,324	·3646 per lb.	9,02,29,868	—12·7
		Total ...	4,20,24,17,469	—0·3

* Declared value.

It will be seen that the total value in 1908-09 was Rs.4,20,24,17,469 (about £280,161,000) and fell short of the value in 1907-08 by only 0·3 per cent. This by itself tells little. It is necessary to show how far the element of price entered into this decline. To do so we must establish in each case what would have been the value of the reduced outturn at the price level of the earlier year. We find these values to be as follows :—

@ Rs. 93·95	Cotton	...	31,22,59,850
37·02	Jute	...	23,36,25,816
93·34	Wheat	...	56,97,66,028
123·03	Rice	...	2,45,38,03,634
139·34	Linseed	...	2,27,82,090
149·49	Rape & mustard		10,28,49,120
207·96	Sesamum	...	10,25,03,484
154·7	Groundnut	...	6,83,77,400
0·4167	Tea	...	10,31,23,384
			3,99,91,80,806

This sum of Rs. 3,99,91,80,806 (£266,612,000) is less by Rs. 20,32,36,653 (£13,549,110·2) than the value of the same volume of commodities at the prices actually obtained for it as shown in Statement II. This difference represents about 4·84 per cent. of earlier year's value, and marks the amount of decline that would have arisen from shrinkage of outturn alone if there had been no change of price. But the actual loss of value was only 0·3 per cent; so, deducting this from 4·84 per cent, it appears that the rise in prices recouped the shrinkage of outturn to the extent of more than 4·5 per cent.

When the reader looks more closely into the figures it will at once occur to him that the extraordinary decline in the price of jute in spite of a contraction in the output was due to conditions extraneous to that crop and tends to vitiate the calculation. But in the first place it must be remembered that the contraction in the demand for jute goods was accentuated by the shortage of crops in India, so that in this sense the decline in price is cogent to our enquiry. In the second place there are on the list several other commodities (*e. g.*, rice) in which a large expansion in outturn was accompanied by a substantial rise in price. And as it is dangerous to trim statistical problems by eliminating all items that in any way clash with the hypothesis we have set ourselves to illustrate, we prefer to leave the foregoing figures to speak for themselves. The point established by them is that in respect of those Indian prices for which statistics are available a quantitative contraction of nearly five per cent. was almost completely recouped by the attendant rise in prices.

POPULAR AGRICULTURAL INSTRUCTION IN THE UNITED STATES.

By E. A. CODDINGTON.

(From the *Philippine Agricultural Review*, Vol. II., No. 7, July, 1909.)

AGRICULTURAL EXHIBIT TRAINS.

For some years past it has been a custom in several of the Western States for the leading railroad companies to build and equip railroad cars, and for the State officials or promotion organizations to fill them with exhibits of the agricultural products from the different parts of a State to demonstrate the natural richness of the soils and the country for the purpose of inducing settlers and others to purchase lands in the State and develop its agricultural resources. These cars, with attendants, lecturers, and demonstrators, sometimes three or four of them together, having been thoroughly advertised in the section to be visited, have been sent over all the principal railroad lines into the North and South Central, the Eastern, and the New England States, where they were sidetracked in the principal cities and exhibited their agricultural productions, while lectures were given and printed matter distributed with the purpose of giving the people in the more thickly settled sections of the United States an adequate idea of the wonderful agricultural possibilities in such States as Washington, Idaho, Oregon, Utah, and California.

In some cases boats have been equipped with similar exhibits and sent from port to port where they have remained several days at a time exhibiting the products of the particular State or section which they represent; in like manner lectures and descriptions of the country and its possibilities were given, and much printed and illustrated matter distributed. These methods of popular instruction or advertising have been carried on for years by various Western States, and have given a wonderful stimulus to the development of agriculture west of the Mississippi River and along the Pacific Coast.

AGRICULTURAL AND HORTICULTURAL DEMONSTRATION TRAINS.

In the March number of the *Rural Californian* we find the following notice of a special agricultural and horticultural demonstration train:—

The Southern Pacific Railway Company will operate a special agricultural

and horticultural demonstration train. The University of California and the State Horticultural Commission, through scientific and practical men, will have delivered, at stopping points, lectures on methods to be pursued in increasing the value of agriculture, horticulture, live-stock raising, dairying, poultry raising and kindred industries. The equipment of the train will include two cars containing valuable and comprehensive exhibits to be used in illustrating and demonstrating the points brought forth in the discussions. There will also be a coach for use as a lecture room in towns where no hall is available. Every person in the sections visited, who is interested, is earnestly invited to attend these meetings. Where the place of meeting is elsewhere than in the train, it will be made known locally through the railway agents, newspapers, and other sources of information.

The schedule and speakers are as follows:—Dr. Benjamin Ide Wheeler, president of the University of California; Prof. E. J. Wickson, director of the experiment station; Prof. W. T. Clark, superintendent of the department of university extension in agriculture; Prof. G. W. Shaw, of the cereal department; Prof. R. H. Loughridge, soils and fertilizers; Prof. E. W. Major, department of animal industry; Prof. W. B. Herms, medical entomolgy; Prof. H. M. Quayle, entomology; Dr. C. M. Haring, veterinary department; Prof. E. B. Babcock, department of plant pathology; Mrs. M. E. Sherman, viticulture, table grapes; Prof. R. E. Smith, southern California pathological laboratory, Whittier; H. J. Ramsey and T. F. Hunt, citrus experiment station, Riverside; J. E. Neff, Anaheim, conductor of farmers' institutes in southern California; J. W. Jefferey, State horticultural commissioner; E. M. Ehrhorn, deputy horticultural commissioner; E. K. Carnes, superintendent of State insectary; Frederick Masky, fumigation expert.

According to the proposed schedule, the train will leave Los Angelos in the morning of March 10. The places to be visited and the hours at which meetings are to be held in those places will be as follows:—

" *Wednesday, March 10.*—Pasadena, 9-30 to 11-30 a.m.; San Marino, 1 to 2 p.m.; Arcadia, 2-10 to 3-10 p.m.; Monrovia, 3-30 to 4-20 p.m.; Duarte 4-30 to 5-30 p.m., also 7-30 to 9-30 p.m.

Thursday, March 11.—San Gabriel, 9 to 11 a.m.; Monte, 11-15 a.m. to 12-15 p.m., also 1-15 to 2-15 p.m.; London, 3 to 5 p.m., also 7-30 to 9-30 p.m.

FARMERS' INSTITUTE TRAINS.

More recently the large railroad companies have co-operated with the Department of Agriculture of the United States of the bureaus of agriculture in the different States and equipped cars, while the National or one of the State departments of agriculture furnishes speakers and lecturers. These cars are sent through the sections which are specially devoted to some staple crop, such as corn, wheat, cotton, etc., and lectures are given at each station on the best methods of growing corn, wheat, or cotton—the subject being the staple crop of the section of country which each car visits.

In accordance with this plan each car proceeds on a well-advertised schedule, drawn by the trains of the railroad company, to the stations where it has been advertised and the people have already congregated. The people enter the car, are seated, and a lecture is given on the particular crop in which they are most interested; after the lecture is over the car is drawn by the railroad company to the next station, where the people are in waiting, and another lecture is given on the same subject. This is continued from station to station throughout the sections in which a particular crop is raised, and in this manner much valuable information is disseminated and a great deal of interest and enthusiasm for more intelligent agricultural work is aroused.

This plan is usually carried out on the initiative of the great railroad companies for the increased profit that will come to them from the larger crops raised by the farmers along their lines and delivered to them for transportation. Usually the Government of the State or the United States furnishes the literature and the necessary equipment or apparatus for the lectures and demonstrations, and the railroad company furnishes the car or cars and carries out the scheme according to their own convenience for the development of the country.

In the same number of the *Rural Californian* above mentioned we find the following notice of the Southern Pacific Farmers' Institute train:—

In a communication to the *Californian Cultivator*, Prof. Warren T. Clark says in discussing the trips of the demonstration train now being run over the State: "The next trip, which will begin in the latter part of February, will cover a part of the southern portion of the State. The route taken will probably be as follows: Bakersfield, Lancaster, Newhall, Los Angelos, San Gabriel, Monte, Covina, San Dimas, Lordsburg, Pomona, Lemon, Chino, Ontario, Bloomington, Colton, San Bernardino, Redlands, Crafton, Highgrove, Riverside, Redlands Junction, Beaumont, Banning, Indio, Coachella, Thermal, Mecca, Browley, Imperial, El Cantro, Heber, Calexico.

"During all or a part of the time that the train is in southern California the following University representatives will accompany it: President Benj. Ide Wheeler; Prof. W. T. Clark, superintendent of university extension in agriculture; Mr. J. B. Neff of Anaheim, conductor of farmers' institutes for southern California; Prof. F. T. Boiletti, viticulture; Mr. R. E. Mansell, cover crops and truck gardening; Prof. C. M. Major, animal industry, and Prof. Ralph E. Smith, plant pathology. Other experts will be called on as the occasion may demand.

This plan has seemed so novel to Europeans that the *London Illustrated News* for February 6, 1909, devoted a full-page illustration to the subject, entitling it "A school-house on wheels, or learning farming aboard a train." The following comment was made: "America's encouragement of agriculture: a lecture on scientific farming in a railroad carriage. Without some scientific knowledge the farmer of to-day cannot expect to succeed. America, realising this, is teaching those engaged in agricultural pursuits how they should follow their business. The first of several trains that are to be used as moving schoolhouses is now on the road. Lectures on farming are given and stoppages are made wherever it is thought necessary. Each talk lasts forty-five minutes, and it is a fact worthy of notice that many women attend the courses."

NATIONAL ORGANIZATIONS.

The National Department of Agriculture.—Beside the above means of popular agricultural instruction in the United States there are many ways more common to the people at large in which agricultural knowledge is disseminated. Perhaps the most prominent of these different means of disseminating agricultural knowledge is through the work of the National Department of Agriculture, which includes the Weather Bureau, Bureaus of Animal Industry, Plant Industry, Chemistry, Soils, Entomology, Biological Survey, Statistics, the Forest Service Division of Publications, the Office of Experiment Stations, and the Office of Public Roads, and has through its various officials and employees, such as the directors of

different kinds of agricultural work, experts, and lecturers, accomplished as much or more toward the progress of agriculture and the general improvement of the country than any other Bureau of the National Government. Mr. Roosevelt stated that he believed that the Department of Agriculture benefited the country more for the money invested than any other Department of the Government.

Demonstration Farms.—A most interesting feature of the educational work organized by the United States Department of Agriculture is that which is carried on by means of the demonstration farms of the Department. These farms were started with the object of showing, by numerous practical examples over a large area, the advantages of improved methods of agriculture. The depredations of the Mexican cotton boll weevil, which threatened the entire destruction of the cotton crop in many districts, was one of the chief reasons which led to the starting of this work.

The term "demonstration farm" is used to designate a portion of land on a farm that is worked strictly according to instructions. This is visited by an agent once a month to see that these instructions are carried out, and to give further advice if necessary. The farmers who co-operate and give reports on results also agree to cultivate their crops according to instructions, but are not visited regularly by the agents.

State Departments of Agriculture.—In co-operation with the National Department of Agriculture are the State departments or boards of agriculture, which form an important part of the Government of each State. Twenty-one of the States and Territories have commissioners of agriculture and twenty-nine of them have State boards of agriculture. In all of the States and Territories except Alaska, Hawaii and Porto Rico advantage is taken of the provisions of the Acts of Congress of July 2, 1862, and August 30, 1890, providing for agricultural instruction. The number of these institutions is sixty-five. In twenty-one States the agricultural colleges are departments of the State universities. The total number of persons engaged in agricultural education and research at the land-grant colleges and experiment stations in 1907 was 6,243, and the number of students 66,193. The agricultural experiment stations are, with very few exceptions, departments of the agricultural colleges.

National Commissions and Organizations.—Some of the movements on the part of the National Government for the development of agriculture and the improvement of country life have been the meeting of the governors of all of the States in Washington for a conference with the President regarding matters which were of most concern for the development and promotion of the best interests of the people of the different States, the calling of the National Conservation Commission and the appointment of the Commission on Country Life by President Roosevelt. Beside these newly-inaugurated movements there are many permanent organizations such as the Association of American Agricultural Colleges and Experiments Stations, American Association of Farmers' Institute Workers, American National Live Stock Association, National Wool Growers' Association, National Dairy Association, American Breeders' Association, forestry associations, schools of forestry, National Bee Keepers' Association, Farmers' National Congress, Patrons of Husbandry, and horticultural societies.

The Graduate School of Agriculture.—Other gatherings which were of no little importance and should not be overlooked were the sessions of the Graduate School of Agriculture. The third session was held at Ithaca and Geneva, N. Y., July 6 to 31, 1908. Dr. A. C. True, Director of the Agricultural Experiment Stations, United States Department of Agriculture, served as dean and Prof. G. N. Lauman, of the College of Agriculture of Cornell University, acted as registrar. This school was organized through the standing committee on graduate study of the Association of American Agricultural Colleges and Experiment Stations. During the sessions of the Graduate School meetings of the following organizations were held: American Society of Agronomy, Association of Dairy Instructors and Investigators, International Conference of Poultry Instructors and Investigators. It is estimated that at least 350 persons attended the sessions of the school. At the closing meeting Dr. True said: "Probably never before has there been gathered together for so extended a period so large and enthusiastic a body of scientific men interested in agriculture."

Farmers' Unions.—Besides the above-mentioned meetings and conferences, which were of national importance, there are local, State, and national gatherings of the Patrons of Husbandry and other Farmers' unions, which are organized in almost every State and, in fact, in almost every township, if not every town, in every county and State in the Union. The Patrons of Husbandry, or

the Grange, while it claims to be a secret society, is organized solely for the promotion of the interests of the farmer and the improvement of the conditions which surround country life.

The Farm Press.—A very important factor in the line of agricultural instruction and co-operation, one which has only been started in the Philippine Islands, is the work of the agricultural press. In almost every State there are papers devoted to the particular agricultural interests of the various sections of the State, which materially assist the farmers who read them, and furnish a medium of communication between farmers of different sections, enabling them to better cooperate with one another and assist each other in the different lines of agricultural work which they are carrying on.

LOCAL ORGANIZATIONS.

Farmers' Institutes.—Another means of popular agricultural instruction, which is voluntary or the part of the people in almost every large section or community, is the Farmers' Institute, which in most cases closely co-operates with the agricultural college and experiment stations of the State. These organizations of farmers hold meetings at least once or twice yearly, at which farmers from the different parts of a section discuss questions regarding the best methods of raising the crops in which they are interested and the best means for promoting their general interests at home and abroad. Through co-operation with the State department of agriculture or the State agricultural college these meetings are usually furnished with lecturers or instructors on those lines of agriculture in which the farmers of the particular section are most interested. On the other hand, through the work of the State agricultural colleges or experiment stations in many States, the farmers who have organized themselves into institutes, associations, or unions are induced to visit the State agricultural college and experiment station at least once during the year, at which time the lines of work which are being carried on at the college or station are explained to the farmers, and such questions as are of most importance are dealt with in general discussions or conferences which the farmers are invited to attend and participate in. Such excursions tend to bring the farmers into much closer sympathy and communication with the agricultural college and the experiment stations of their State. In many cases there is very close sympathy and co-operation on the part of the farmers with the colleges and experiment stations, and many questions of importance to the farmers are immediately referred to the college or experiment station where they are taken up, investigated, and answered to the satisfaction of the individual farmer.

State and County Fairs.—Another source of agricultural information and instruction, which should not be neglected, is what is popularly known as State and county fairs. At these fairs, which are often held in the smaller sections of the States, the products of the farms from the country around are exhibited and various money prizes, awards, medals, premiums, etc., are given for excellence or superiority of the different products. In some States almost every county has a county fair, and later on, in most States, a State fair and agricultural exposition is held. Before these fairs the farmers vieo with one another endeavoring to raise the best products on their farms, and as a consequence of their desire to excel there is a natural demand for further information regarding the best means of raising the different crops and of breeding the best farm animals. In this way many of them are brought into communication with the State colleges and experiment stations which are organized for the promotion of the best interests of the farmers and the advancement of life in the counrty.

THE FARMERS' SCHOOLS.

The Work of the Common School.—Another source of popular agricultural instruction, and one which has for a long time been neglected, is the work of the schools for the farmers' children. Mr. John E. Bell, writing for *The Outlook* of April 10 last, says:—

A little preliminary awakening is taking place along this line, but as a rule the farmers' teacher is not fitted by education, understanding, or inclination to teach the farmers' school. The farmer should be taught his business in his school; but what is the standing of agriculture in our country schools? Why, the average teacher of the farmers' school, it might be said, knows nothing about the nature of farming, cares nothing, dislikes the farm, and is teaching as a step toward getting away from the farm. When the teacher of the farmers' boy wishes to incite him to study and effort, wishes to create ambition, he tells the boy that if he studies hard and learns well he may some day be a clerk in a store, or a bookkeeper, and tells the girl that she may become a stenographer and typewriter.

The following table is compiled from the United States Census for 1900, and the Census of the Philippine Islands for 1903:—

The total number of persons engaged in gainful occupations in the United States is placed at 29,286,000 or 36·3 per cent., in the Philippine Islands 3,037,880, or 43·5 per cent., classified as follows:—

	United States.		Philippine Islands
	No.	Per ct.	(per ct.)
Agricultural pursuits...	10,438,000	35·7	41·3
Manufacturing and mechanical pursuits ...	7,113,000	24·4	31·6
Domestic and personal service	5,691,000	19·2	18·87
Trade and transportation	4,778,000	16·4	7·5
Professional service ...	1,264,000	4·3	0·8

It has been recognized for some years past that the course of study for the common schools is made up solely for the purpose of preparing the children in the schools for advanced training in high schools, academies, and colleges. Our school-books have been prepared on the science basis and the literary basis, and with scientific or academic objects in view, to such an extent that we have had science readers and stepping stones to literature as the substance of reading matter for the boys and girls in the country schools for more than a decade. While the courses of study for practically all of our schools in the United States and the Philippine Islands have been made upon the basis for preparing for advanced scientific, literary, or classical education, it is a recognized fact that not exceeding 10 per cent. of the boys and girls are ever able to take advantage of such advanced training or education, and the remaining 90 per cent. who must follow agricultural, manufacturing, and mechanical pursuits, trade and transportation, domestic or personal service, receive no consideration whatever in the course of study or the work of the common schools. In short, the whole purpose and plan of our educational system is solely for the benefit of the well-to-do 10 per cent. of the population who may enjoy the opportunity of advanced training in high schools, academies, colleges, and possibly universities.

It would seem that the teachers of our common schools, more particularly the country schools, should be prepared to instruct the boys and girls in those subjects and along those lines of learning which they need for their future life work, inscead of training them along literary, scientific, or classical lines, as is the case at present both here and in the United States.

It would seem that, in the country schools at least, the farmers' daughters should be taught—without books—something of home economy, of the value of different foods and the best methods of preparing them, the elements of sewing, in short a better knowledge of domestic science and art than they obtain at home. It would seem that in the country school the teacher should be qualified to train—without books—the boys and girls of the country in the fundamentals of such subjects as the following:—

(1) The nature and value of different soils.

(2) The selection of seed.

(3) Methods of seed testing.

(4) The planting of trees.

(5) The practice and principles of pruning.

(6) The practice and principles of grafting.

(7) How to start home fruit gardens.

(8) The treatment of the common plants, fruits, and grains for the prevention of common diseases.

(9) The nature of common animal diseases and how to treat them.

(10) The elements of drainage.

(11) The elements of irrigation.

(12) The making of plans for school gardens.

(13) Plans for the improvement and beautifying of home and school grounds. A better knowledge of these things by the boys and girls of the country means a higher standard of living and life for the country and the nation, and a higher working efficiency of the individual citizen.

Along this line many popular books have been produced in the United States, among the foremost are "Among Country Schools" by O. J. Kern, several books by Prof. L. H. Bailey, of the Agricultural College for Cornell University; the reports of the United States Commissioner of Education and the National Educational Association. These reports contain accounts of the school garden movement and the move for agricultural education in country schools in Germany, Prussia, France, Holland, Sweden, and Russia.

SCHOOL MOVEMENTS.

While the work of our country schools has been solely for those who could afford to go to high schools, colleges, and universities, those who choose the

farms and the country for their life work—those who, according to Mr. Roosevelt, stand for what is fundamentally best and most needed in our American life—are left to get what they can from the schools, and statistics show that 90 per cent. of them drop out, never take this advanced training, or finish a course. As Mr. Bell has said the farm and the farmer is despised in the farmers' school by his teacher, and eventually by his own children. Recently there has been a tendency on the part of some educators to consider this neglected 90 per cent., the boys and girls of the farmer and working man, who pays for the school. In some States the course of study have been changed so as to train for the business of the farm and the country, to enhance the value of country life, to beautify and make farm homes attractive.

Farmer Boys' Experiment Clubs.—One of the more important movements in the schools for arousing an interest in the business of the farm and a desire for agricultural knowledge is the farmer boys' experiment clubs, which in some cases number as many as 500 boys between 9 and 21 years of age. In these clubs the boys test the vitality of different seeds, make investigations with reference to diseases of plants and animals raised on the farm, experiment with sugar beets and green corn, and in some cases corn-growing contests have been held.

Girls' Home Culture Clubs,—Side by side with the boys' experiment clubs, home culture clubs are being organized for girls, in which the girls have general cooking contests, bread-making contests, and needlework contests. Through these clubs almost unbounded interest has been aroused in the work of the home and the farm, the everyday life of the boys and girls is made much more attractive, and country life takes on a new meaning. Beside the advantage of turning the minds of our young men and women to the improvement of country life, there is not that discontent which comes from educating them to ideals they can never realize and leaving them untrained and unprepared for the service they must perform.

Educational Excursions.—In addition to the organization and the contests of the boys' experiment clubs and the girls' home culture clubs, many educational excursions are planned and made by them to State agricultural colleges, State universities, or State capitals, and thus a knowledge is obtained at first hand of the direction and the results of the different lines of government work, of commerical and social conditions outside of the little community in which they usually live.

POONA AGRICULTURAL CONFERENCE.

SPEECH BY THE GOVERNOR.

(From the *Indian Agriculturist*, Vol. XXXIV., No. 10, Oct. 1, 1909.)

The Council Hall, Poona, was crowded to its utmost capacity on September 29 with Chiefs, Sardaars, and a great many others from different parts of the Presidency at the Agricultural Conference. The Conference was presided over by H. E. the Governor, and Sir John Muir Mackenzie, the Hon. Mr. Jenkins, H. H. the Gaekwar, H. H. the Maharaja of Kolhapur, and H. H. the Maharaja of Idar were on the dais with his Excellency.

THE GOVERNOR'S SPEECH.

His Excellency the Governor opened the proceedings. In doing so, he said: "Chiefs, Sardaars, and gentlemen,—In India it is not easy to say anything that will not be disputed or criticised, but the two propositions which I wish to lay before you should command universal acceptance even though their import is imperfectly recognised. In the first place agriculture is, and must, remain by far the most important of real Indian industries and the essential basis of India's prosperity. In the second place Indian agriculture, allowing for climate vagaries, is in a distinctly backward position. Production is not what it might become, and waste in many forms is rampant in many places. The provision of an adequate food supply is a primary condition of the existence of mankind and the great growth of the population in India which has accompanied the British Rule and which is still proceeding, entails more and more demands upon the land. I do not know whether the prevailing high prices which have been advantageous to the cultivators are not due, in part at least, to a growing disproportion between the population and the production of food stuffs, or whether they arise from other and temporary causes. Investigation may throw some light on this important question, but the fact remains that 290 millions of people in India must be fed, and that the food supply will have to be increased as the years go on, and that a point may be reached at which the growth of other staples will have to be checked unless the production of the necessities of life can be increased.

"This may become a problem for the whole world before another century has passed. It is doubtful whether the food-supply is keeping pace with the steady growth of population, and an unfortunate coincidence of bad crops in many localities would already create a serious shortage. Some great countries have ceased to be able to feed themselves. In the British Islands this stage was reached many years ago, and in 1907 they imported grain and flour alone to the value of nearly 75½ millions sterling and meat costing nearly 52 millions. Germany is becoming more and more dependent upon imported food. The United States, once great exporters, are dropping out of

The Wheat Market

and may have to trust in the future to Canada, where great fertile tracts have not yet felt the plough.

"In Eastern countries the Chinese and the Japanese being excellent cultivators probably extract nearly the full value from their soils, and the home demands of the latter are increasing. India not only feeds herself except in such an important item as sugar, but derives a large source of income from the produce of the land. It is supremely important that this position should be maintained, and that, while continuing to feed her people and endeavouring to reduce the imports of staples that can be grown on her soil she should not lose her export trade. How important that trade is I wish to explain. You have perhaps been told that before the advent of the British Rule, India had an immense trade which has since disappeared. I am sure you understand, however, that the trade of those halcyon days was a bagatelle in value compared with that which India now enjoys. Excluding Government stores, India exported merchandise to the amount of about 115½ millions sterling in 1907-08. This was a record year both for exports and imports, and in 1908-09 the former fell to about 99¾ millions owing to a deficiency of crops. Now the point which I want you to remember is that of these 99¾ millions very nearly 73 millions were paid to India for the produce of the land. It may well be that you do not realise this important aspect of agriculture from which the Deccan does not largely profit, but it needs no imagination to grasp the fact that the realization of nearly 73 millions sterling in an indifferent year must have an immensely beneficial effect upon the economies of India as a whole. And this benefit is derived wholly from agriculture. Much has been written about the need for the promotion of industries which, it has been stated, Government desires to check. I need not tell you that such statements are baseless. Government is doing all it can to encourage industries, but if I have made my meaning clear you will understand that a sudden expansion of manufacturing industries on a large scale would be disadvantageous. There is already a shortage of labour in some localities, and the population of this Presidency is not at present capable of supplying a large additional surplus to work in factories without depleting the numbers required for the vital necessities of agriculture and for great public works. The food supply must be maintained and will have to be increased.

The Foreign Trade

derived from the land must not be lost. The density of the population in some parts of India is greater than with us, but even in these parts a rapid transfer of a large number of country dwellers to town life, such as has happened in industrialized countries, would be an evil since the restrictions and regulations to which European town dwellers submit would be bitterly resented by the people. In the United States the dwellers in towns numbered 3 per cent. of the population after the Civil War. Forty years later 33 per cent. were living in cities of over 8,000 peoole. In England and Wales the town population increased from 50 per cent. to 77 per cent. in fifty years. If far less changes than these took place in India the effects would be serious and the factory Colony outside the city, of which the Poona paper mills supply a good example, points to a way of avoiding the evils of overcrowding. Meanwhile, factory industries as a whole continue to develop by a process of natural evolution subject to the fluctuations which affect all countries. The cotton mills have increased from 74 in 1883-1884 to 227 in 1907-1908, and jute mills from 23 to 50 in the same period. Spindles have increased in a far higher proportion. Statements as to the decay of trade and industry are refuted by the smallest study of the facts.

"In India, as in all countries, the character of trade and of industries has changed, but the Government of both is remarkable, and it is the steady advance, especially in the latter, which affects the social life of the people that we must seek to promote. A very useful line of manufacturing progress for this Presidency at the present time is to be sought in the encouragement of hand industries, such as weaving which would not only bring prosperity to an hereditary class but might enable the earn-

ings of the cultivator to be increased. The Government recently appointed Mr. Mehta to survey the handloom industry, and from the useful report which he has prepared I gather that this branch of work is capable of development on the two conditions of improved methods and co-operative agencies. In the production of eri silk also, which is being urged by a Government expert, there is a possible opening for easy and profitable labour for women and children.

"I have endeavoured to show the vital importance of the products of the land in regard to the feeding of the people and to the export trade. If you turn to the import trade the one great item indicating a deficiency of production is sugar. The value of the imports of which reached the record figure of 7¼ millions sterling in 1908-1909. I have no doubt that this figure can be reduced. Government by its great irrigation works and by giving financial assistance to

SUGAR CANE GROWERS

is doing all in its power to increase the production of this important food staple. Meanwhile you, as thinking people, will readily understand that to boycott foreign sugar can only inflict hardship on the poor and promote a particularly despicable kind of fraud. From the economic point of view the step is useless because the high profits of sugar cane growing in this Presidency suffice to stimulate its development. The political object which has been recently defined in a letter to the London *Times* by a high Indian authority to draw the attention of the British public to the partition of Bengal is obiviously futile in the case of sugar, since the total abolition of the imported would not affect the public in the slightest degree and would fall mainly upon the Asiatic cultivators of Java and Mauritius, and in a less degree upon the best growers of Central Europe. The old saying that the greatest of benefactors is the man who can make two blades of grass grow where one grew before, applies with peculiar force to India, and the best service which could be rendered the country at the present time is to increase agricultural production. For various reasons the greatest of Indian industries is backward in many respects. The methods are antiquated and inadequate, even where the condition of rainfall and of irrigation are favourable. The average wheat product of England is 32 bushels per acre; in the Bombay Presidency it is 21 bushels on irrigated and 8 bushels on unirrigated land. In parts of the Deccan weeds run riot in the fields, and the cultivator may be seen sowing his crop among them. There are even places where the land has been abandoned to weeds which grow strongest in the soil, and cultivation is thus driven to soil of inferior quality. Even in a year of good rainfall like the present, the aggregate production will not approach what is possible. The tillage of the land is insufficient and the selection of seed is not understood. The uses of manure are little appreciated, and night-soil, which is a source of large profit to the Japanese, is unutilised.

THE BREEDING OF STOCK

is mainly left to chance with the necessary result of deterioration and waste. Healthy and diseased animals intermingle with consequent but preventible loss.

"In such conditions as these improvement of the land which has been a marked feature in Japan is necessarily absent, and there is probably a growing infertility in many places. The Japanese who rank amongst the best natural cultivators of the world have the advantages of a good rainfall. Having been cut off from communication with the outer world for centuries, and possessing a soul naturally poor, they have been thrown on their own resources. Cattle being exceedingly few the land must be worked by hand and the

INCREASING PRESSURE OF A POPULATION

which has risen from 27¼ millions in 1898 to 47¾ millions in 1905, called forth energies and the innate resourcefulness of the people who make the utmost out of a fertility which their labours have created and who can afford to waste nothing.

"Sir F. Nicholson justly states in an interesting report.—'Tillage and manure, strenuous spade labour, and the utilization of all waste are the main secrets of Japanese husbandry.' In spite of the heavy burden of taxation which in the case of agricultural land was suddenly increased by 120 per cent. to meet the requirements of the Russian War, the Japanese cultivator holds his own. And now that the pressure of population continues to increase, while the cultivable area cannot be expanded, he is showing the wonderful adaptability of his race by quickly adopting the new methods which science can indicate.

"This important Conference has been assembled in the hope of doing something to help the cultivator and to advance the general prosperity which,

as I have tried to point out, depends mainly on him. The science of agriculture is of modern growth, but already immense strides have been made under its auspices in Western countries. I am most anxious that the benefits should be extended to India which stands in the greatest need of them. It is natural and right that you should accept help and guidance from Government in these matters, and the Agricultural Department, which owes so much to my honourable colleague Sir J. Muir Mackenzie, is a proof that we recognize our responsibilities. It is a new department, and it is a baby in comparison with the giant organization maintained in the United States, but if you read the annual report, as I trust you all will do, you will see that valuable work—educational, experimental, and demonstrational—is already in progress. I hope that the members of this Conference will take the opportunity of visiting the College farms and gardens in the neighbourhood, and will see for themselves what Government is trying to accomplish for the good of the people. We want you to give and to receive advice, and our officers are ready now and always to discuss agricultural matters and to

DISTRIBUTE THE SPECIAL KNOWLEDGE

that they have acquired in the science of agriculture. A general solution of the many problems is rarely possible. Each may require a solution depending upon local conditions, local customs, and even local prejudices. The success of a process or of a plant in other countries does not guarantee success here, where it may be necessary to change the process or to produce a special plant in order to suit the conditions of climate, soil, and requirement. The needs of the Deccan differ in many respects from those of Gujarat and of Sind. You will, therefore, see the importance of experiments scientifically carried out by a central body, and you may be able to give valuable assistance by communicating with the Department. I am glad to know that some of the Chiefs and Sardars in the Presidency are actively interesting themselves in the improvement of agriculture, and I am sure they will co-operate with us for the general good. The main requirements are capital, labour and knowledge, but above all knowledge without which capital and labour would be wasted. Only a century ago there were large tracts which lay waste for years as the result of the devastation of armies and of depopulation. These tracts have been brought under cultivation, but the

IMPROVING PROCESS

which in England and other countries has been brought about by a combination of labour and capital, and in Japan mainly by highly intelligent labour alone, has been absent. While, therefore, there are many good and industrious cultivators, production has been disappointing, and there has been a series of indifferent years which might have caused despair among people less sturdy and less hopeful than the Mahrattas. Losses due to bad seasons lie beyond our power to prevent. All that Government can do is to extend irrigation, and you may be sure that we shall spare no effort and no argument to obtain sanction for the great Deccan projects now being elaborated. I allude especially to the Gokak and the Nira right bank schemes which will command respectively 490,000 and 700,000 acres, while the latter will safeguard the most famine-stricken districts of the Deccan. If these great works did not immediately earn the prescribed rate of interest, as I believe they would, the indirect benefits would be so immense as to demand their construction. Apart, however, from the extension of large irrigation works, there is much that could be done to reduce loss in bad seasons and to ensure a great increase of production when the rainfall is favourable. Our jagirdars, inamdars, landlords, and substantial cultivators will find that it will pay to apply capital to the improvement of their lands. Levelling and bunding the erection of tals to prevent wash, fencing to protect the fields from the cattle and the cattle from the fields, the digging of wells to utilise subsoil water, the harnessing of nalas to catch surface water, the installation of pumping plant on river banks, these are some of the requirements, and if they are approached with knowledge, they will prove safe and profitable investments. Similarly in the use of manures, in the

SELECTION OF SEEDS

in sowing, where there is now much waste, and in improved tillage there is ample scope for progress. The last annual report of the Agricultural Department points out that if jowari seed is treated with sulphate of copper, costing one anna an acre, there will often be 'a profit of a hundred-fold and more.' Here is a way in which the investment of capital on an insignificant scale will prove remunerative. As to investment on the larger scale, such as the purchase of iron ploughs and of pumping or cane crushing plant, you will find some useful information in the report. Even in

dry years sources of sorely needed water are wasted for the want of power pumps. The practical questions which confront us are 'how can we bring the knowledge already available and certain to be increased year by year to bear upon the people, and how can the poor cultivators be helped in the matter of capital.' I earnestly hope that the members of this Conference will be able to give us valuable help and advice in solving these important questions.

AGRICULTURAL ASSOCIATIONS.

"We are anxious to increase the number of agricultural associations, and I am glad to note that ten such bodies were inaugurated during the past year, and that many Indian gentlemen are rendering great assistance. Each such association can be the centre from which practical information, such as is contained in the series of very useful publications edited by Dr. Mann, can be disseminated, but more is wanted, and we require the active agency of local leaders who will supply the initiative in agricultural matters, and will show the people how they can improve their position. Smilarly we have an increasing number of

CO-OPERATIVE SOCIETIES

by means of which with the aid of banks we hope that the benefits of financial combination and of the industrial organisation which has worked wonders in other countries may be made manifest in helping such bodies as these. There is a wide field of practical usefulness for the true patriots of the Presidency who must realize that the uplifting of the cultivators is the greatest boon that could be conferred upon India.

"In this connection I venture to make a strong appeal to the conductors of the Press who could do much to help the people by spreading the knowledge that Government is anxious to provide. It is sad to note that in some quarters vague denunciations which cannot effect any practical good and may do some harm seem to be mistaken for politics which have a far nobler meaning. Criticism based on facts, I welcome, but if our friends the critics would devote some of their energies to the diffusion of knowledge of which the people stand in dire need, I am inclined to think that their criticism would be more effective and that the

PROGRESS OF INDIA

towards nationhood would be more rapid. I am afraid that I have detained you too long, and I will only say in conclusion that I hope that these Conferences will be annual, and that they will help in solving one of our greatest problems, the promotion of the welfare of the patient cultivators upon whom, now and even more in the future, the prosperity and progress of India must depend."

COUNTRY LIFE COMMISSION.

(From the *Philippine Agricultural Review.*, Vol. II., No. 5, May, 1909.)

Our purpose in presenting these articles from the pens of President Roosevelt and the Editor of the *Outlook* is not for their intrinsic value to citizens of the United States, but for their suggestiveness to those of us who are responsible for, and must solve, the problem of country life in the Philippines. Life in the country in these Islands is the foundation of all of the national aspirations and of the future greatness of the Filipino people. It is the country life in the Philippines more than anything else that needs to be awakened and quickened.

The politician is in the very centre of the stage of the popular life of the people at the present time. The Filipino Government official is everything. The country seems to be dormant, and the people in the country depend upon the office holders and politicians for all remedies of present evils and for the improvement of conditions. In the mind of the average country resident the situation is entirely in the hands of the lawmakers, and they, the people in the country, are doing little or nothing, resting in the conviction that everything that is necessary to bring about the much-needed changes for the progress of the country, can be accomplished by their officials and lawmakers. Nothing could be further from the truth. There is no such thing as independent national or state government without resources, and laws are primarily for the regulation of the conduct of the people. Laws cannot make the people industrious, nor can they fundamentally create resources. Abundant resources and wealth are the foundation of national life, as well as of the life of a business corporation. The country, the farmer, and the rural population are the resources and the fundamental producers of wealth—the foundation of national existence—and through them only can national existence be made possible.

The recent protest of the sugar planters is much like a protest against the building of a house without a foundation

This is the first voice which has been heard from the land, from the country people. They are the very people that need to be encouraged to speak for themselves, and life in the country needs to be stimulated and given every possible support and encouragement. In fact, it should be made the centre of attention both of the people and the Government. The eyes of the public should be turned to the farmers and the country people, and they should be placed in the centre of the stage of action. For a time, at least, the politician can well be forgotten and left to work out his problems, not so much in the public forum, but rather in conference with the people who are the real producers of wealth.

For the past eight years we have been facing the condition of importing annually an average of £13,758,890 worth of rice, £154,570 worth of coffee, £368.114 worth of cacao and chocolate, £237,248 worth of sugar, £552,108 worth of eggs, £14,216,238 worth of cotton goods. The United States might as reasonably import her wheat, milk, butter, meat and potatoes. *Such a national foundation is as frail as straw and as unstable as water, such a condition is a condition of dependence and not independence.* A country in which the people will not produce the food staples necessary for their own subsistence and right living, when the land naturally produces such products, can be nothing more than a dependency no matter how brilliant its statesmen and professional men,

The editor knows of no better expression or statement of the needs of the people and the government of this country—in order that the Filipinos may attain to the ends most desired by them—than the following by a prominent Filipino :—

We should earn sufficient money to live in such a manner as to produce healthy and vigorous children, and educate them so that their earning capacity will be still greater. In which case, I swear upon my honour that our grandchildren with their health, education, and money will be independent in spite of everything. * * * America freed herself from England because she had men, money, and true patriots.

In his message President Roosevelt points out the various agencies for the improvement of country life, namely :—

(1) The National Department of Agriculture.

(2) The State Departments of Agriculture.

(3) The State Colleges of Agriculture

(4) University and Agricultural Extension Work.

(5) Agricultural Experiment Stations.

(6) Farmers' Union,

(7) The Grange, and

(8) The Agricultural Press.

In the Philippines we have but few of these agencies in either the Insular, provincial, and municipal government organisations or among the people. Act No. 1829 provides for civico-educational instruction, yet the need of agents or officials charged with the responsibility for improving the existing conditions of country life is manifest and decidedly emphatic to anyone who fairly considers the situation.

The President emphasizes the importance of organization on the part of the farmers themselves, and states that the country people must organize to protect their interests as well as any other class of industrial workers. The Government can point out the way, but as indicated, the country people must co-operate and must give dignity and attractiveness, as well as better results from the farms, if country life is made all that it can and should be. In the Philippines we not only need better farming, which the Bureau of Agriculture is endeavouring to stimulate and encourage, but we most emphatically need *better business* and *better living on the farms.* President Roosevelt states that the farmers' problems are the whole country's problems. The President further asserts that neglect of this subject has held back country life and lowered the efficiency of the whole nation. Perhaps no other subjects received so little attention during the period in which the Philippine Islands were governed by the Spaniards as the education and elevation of the people in the country, and work for the improvement and development of those things which were for the best interests of the country people. The President declares that the strengthening of country life is the strengthening of the nation, that while the growing of crops is an essential foundation, it is only a part of the life of the people in an intelligent and progressive country, that it is literally vital that the farmer, his wife, and his children shall lead the right kind of life. He believes that the National Department of Agriculture should become a department of country life, fitted to deal not only with crops, but with questions pertaining to all of the larger aspects of life in the open country.

President Roosevelt points out three great needs of country life, namely :—

I. *Effective co-operation among farmers to put them on a level with the organized interests with which they do business.*

II. *A new kind of schools in the country which shall teach the children as much outdoors as indoors and perhaps more, so that they will prepare for country life and not, as at present, mainly for life in town.*

III. *Better means of communication, including good roads and a parcels post.*

In addition to these he suggests a fourth, viz:—

Better sanitation, Inasmuch as many easily preventable diseases hold millions of country people in the slavery of continuous ill-health.

In conclusion, President Roosevelt warns our countrymen that the great recent progress in city life is not a full measure of our civilization, for our civilization rests at bottom on the wholesomeness, the attractiveness, and the completeness, as well as the prosperity of life in the country. The men and women in the farm stand for what is fundamentally best and most needed in our American life.

Some time ago President Roosevelt appointed Prof. L. H. Bailey, Director of the Agricultural College and Experiment Station for Cornell University, Mr. Gifford Pinchot, Chief of the United States Forestry Service, Washington D.C., Mr. Walter H. Page, Editor of "Country Life in America," President Kenyon L. Butterfield, of the Massachusetts Agricultural College, and Mr. Henry Wallace, editor of the "Wallace Farmer," in Iowa, as a Commission to investigate the conditions of life on the farms of the country, and to make recommendations as to the best ways and means by which farm life can be made more remunerative and attractive.

The Commissoners held thirty public hearings among the people from forty different States and Territories, and have 120,000 answers to printed questions. The members of the Commission have received nothing for their work on the Commission, and their service is an expression of public spirit which is a credit, and, perhaps, one of the best resources any nation could have.

PRESIDENT ROOSEVELT'S MESSAGE.

On February 9, last, President Roosevelt submitted the report of the Commission to Congress. The President's message commenting on the work of the Commission is as follows:—

I transmit herewith the report of the Commission on Country Life. At the outset I desire to point out that not a dollar of the public money has been paid to any Commissioner for his work on the Commission.

The report shows the general condition of farming life in the open country, and points out its larger problems. It indicates ways in which the Government, National and State, may show the people how to solve some of these problems, and it suggests continuance of the work which the Commission began.

METHODS OF THE COMMISSION.

Judging by thirty public hearings, to which farmers and farmers' wives from forty States and Territories came, and from 120,000 answers to printed questions sent out by the Department of Agriculture, the Commission finds that the general level of country life is high compared with any preceding time or with any other land, If it has in recent years slipped down in some places, it has risen in more places. Its progress has been general if not uniform.

Yet farming does not yield either the profit or the satisfaction that it ought to yield and may be made to yield. There is discontent in the country and in places discouragement. Farmers as a class do not magnify their calling, and the movement to the towns though, I am happy to say, less than formerly, is still strong.

HOW FARMERS CAN HELP THEMSELVES.

Under our system it is helpful to promote discussion of ways in which the people can help themselves. There are three main directions in which the farmers can help themselves, namely; I, *Better farming*; II, *better business*; III, *better living on the farms.*

The *National Department of Agriculture*, which has rendered services equalled by no other similar department in any other time or place; the *State Departments of Agriculture*, the *State Colleges of Agriculture and the Mechanic Arts*, especially through their extension work; the *State Agricultural Experiment Stations*, the *Farmers' Union*, the *Grange*, the *Agricultural Press* and other similar agencies have all combined to place within the reach of the American farmer an amount and quality of agricultural information which, if applied, would enable him over large areas to double the production of the farm,

The Object.—The object of the Commission on Country Life, therefore, is not to help the farmer raise better crops, but

to call his attention to the opportunities for *better business and better living on the farm.* If country life is to become what it should be, and what I believe it ultimately will be—one of the most dignified, desirable and sought-after ways of earning a living—the farmer must take advantage not only of the agricultural knowledge which is at his disposal, but of the methods which have raised and continue to raise the standards of living and of intelligence in other callings.

Organisation.—Those engaged in all other industrial and commercial callings have found it necessary under modern economic conditions to organize themselves for mutual advantage and for the protection of their own particular interests in relation to other interests.

The farmers of every progressive European country have realised this essential fact, and have found in the co-operative system exactly the form of business combination they need.

Now, whatever the State may do toward improving the practice of agriculture, it is not within the sphere of any Government to recognize the farmers' business or reconstruct the social life of farming communities. It is, however, quite within its power to use its influence and the machinery of publicity which it can control for calling public attention to the needs and the facts. For example, it is the obvious duty of the Government to call the attention of farmers to the growing monopolization of water power. The farmers, above all, should have that power, on reasonable terms, for cheap transportation, for lighting their homes, and for innumerable uses in the daily tasks on the farm.

FARMERS' OWN CO-OPERATION AND WORK NEEDED.

It would be idle to assert that life on the farm occupies as good a position in dignity, desirability, and business results as the farmers might easily give it if they chose. One of the chief difficulties is the failure of country life as it exists at present to satisfy the higher social and intellectual aspirations of country people. Whether the constant draining away of so much of the best elements in the rural population into the towns is due chiefly to this cause or to the superior business opportunities of city life may be open to question. But no one at all familar with farm life throughout the United States can fail to recognize the necessity for building up the life of the farm upon its social as well as upon its productive side.

It is true that country life has improved greatly in attractiveness, health, and comfort, and that the farmer's earnings are higher than they were. But city life is advancing even more rapidly because of the greater attention which is being given by the citizens of the towns to their own betterment. For just this reason the introduction of effective agricultural co-operation throughout the United States is of the first importance. Where farmers are organized co-operatively they not only avail themselves much more readily of business opportunities and improved methods, but it is found that the organiszations which bring them together in the work of their lives are used also for social and intellectual advancement.

The Co-operative Plan.—This is the best plan of organization wherever men have the right spirit to carry it out. Under this plan any business undertaking is managed by a committee. Every man has one vote, and every one gets profits according to what he sells or buys or supplies. It develops individual responsibility and has a moral as well as a financial value over any other plan.

THE FARMERS' PROBLEMS THE WHOLE COUNTRY'S PROBLEMS.

I desire only to take counsel with the farmers as fellow-citizens. It is not the problem of the farmers alone that I am discussing with them, but a problem which affects every city as well as every farm in the country. It is a problem which the working farmers will have to solve for themselves, but it is a problem which also affects in only less degree all the rest of us, and therefore if we can render any help towards its solution it is not only our duty but our interest to do so.

The foregoing will, I hope, make it clear why I appointed a Commission to consider problems of farm life which have hitherto had far too little attention, and the neglect of which has not only held back life in the country, but also lowered the efficiency of the whole nation. The welfare of the farmer is of vital consequence to the welfare of the whole community. The strengthening of country life, therefore, is the strengthening of the whole nation.

The Commission has tried to help the farmers to see clearly their own problem and to see it as a whole, to distinguish clearly between what the government can do and what the farmers must do for themselves, and it wishes to bring not only the farmers, but the nation as a whole, to realize that the growing of

crops, though an essential part, is only a part of country life. Crop growing is the essential foundation, but it is no less essential that the farmer should get an adequate return for what he grows, and it is no less essential—indeed, it is literally vital—that he and his wife and his children shall lead the right kind of life.

For this reason it is of the first importance that the *United States Department of Agriculture*, through which as prime agent the ideas the Commission stands for must reach the people, *should become without delay, in fact, a department of country life*, fitted to deal not only with crops, but also with all larger aspects of life in the open country.

THREE NEEDS OF COUNTRY LIFE.

From all that has been done and learned three great general and immediate needs of country life stand out:

First.—*Effective co-operation among farmers to put them on a level with the organized interests with which they do business.*

Second.—*A new kind of schools in the country which shall teach the children as much outdoors as indoors and perhaps more, so that they may prepare for country life and not, as at present, mainly for life in town.*

Third.—*Better means of communication, including good roads and a parcels post, which the country people are everywhere, and rightly, unanimous in demanding.*

To these may well be added *better sanitation, for easily preventable diseases hold several millions of country people in the slavery of continuous ill-health.*

ORGANIZATION NECESSARY.

The Commission points out—and I concur in the conclusion—that the most important help that the Government, whether National or State, can give is to show the people how to go about these tasks of organization, education and communication with the best and quickest results. This can be done by the collection and spread of information. One community can thus be informed of what other communities have done, and one country of what other countries have done. Such help by the people's government would lead to a comprehensive plan of organization, education, and communication, and make the farming country better to live in, for intellectual and social reasons as well as for purely agricultural reasons.

The Government through the Department of Agriculture does not cultivate any man's farm for him, but it does put at his service useful knowledge that he would not otherwise get. In the same way the National and State governments might put into the people's hands the new and right knowledge of school work. The task of maintaining and developing the schools would remain, as now, with the people themselves.

MONEY FOR EXPENSES ASKED.

The only recommendation I submit is that an appropriation of $25,000 be provided to enable the Commission to digest the material it has collected and to collect and to digest much more that is within its reach and thus complete its work. This would enable the Commission to gather in the harvest of suggestion which is resulting from the discussion it has stirred up. The Commissioners have served without compensation, and I do not recommend any appropriation for their services, but only for the expenses that will be required to finish the task that they have begun.

To improve our system of agriculture seems to me the most urgent of the tasks which lie before us. But it cannot, in my judgment, be effected by measures which touch only the material and technical side of the subject. The whole business and life of the farmer must also be taken into account. Such consideration led me to appoint the Commission on country life. Our object should be to help develop in the country community, the great ideals of community life as well as of personal character. One of the most important adjuncts to this end must be the country Church, and I invite your attention to what the Commission says of the country church and of the need of an extension of such work as that of the Young Men's Christian Association in country communities. Let me lay special emphasis upon what the Commission says at the very end of its report on personal ideals and local leadership. Everything resolves itself in the end into the question of personality. Neither society nor government can do much for country life unless there is a voluntary response in the personal ideals of the men and women who live in the country.

PLEA FOR FARMERS' WIVES.

In the development of character the home should be more important than the school or than society at large. When once the basic material needs have been met, high ideals may be quite independent of income, but they cannot be realized without sufficient income to provide adequate foundation, and where the community at large is not financially prosperous it is impossible to develop a high average personal and community ideal. In short, the fundamental facts of human nature apply to men and women who live in the country just as

they apply to men and women who live in the towns. Given a sufficient foundation of material well being, the influence of the farmers and farmers' wives on their children becomes the factor of first importance in determining the attitude of the next generation toward farm life. The farmer should realize that the person who most needs consideration on the farm is his wife. I do not in the least mean that she should purchase ease at the expense of duty. Neither man nor woman is really happy or really useful save on condition of doing his or her duty. If the woman shirks her duty as housewife, as home keeper, as the mother whose prime function is to bear and rear a sufficient number of healthy children, then she is not entitled to our regard. But if she does her duty she is more entitled to our regard even than the man who does his duty and the man should show special consideration for her needs.

I warn my countrymen that the great progress made in city life is not a full measure of our civilization, for our civilization rests at bottom on the wholesomeness, the attractiveness and the completeness as well as prosperity of life in the country. The men and women on the farm stand for what is fundamentally best and most needed in our American life. Upon the development of country life rests ultimately our ability, by methods of farming requiring the highest intelligence, to continue to feed and clothe the hungry nations, to supply the city with fresh blood, clean bodies and clear brains that can endure the terrific strain of modern life. We need the development of men in the open country, who will be in the future, as in the past, the stay and strength of the nation in time of war and its guiding and controlling spirit in time of peace.

SPECIAL RECOMMENDATIONS OF THE COMMISSION.

The Commission enumerates eleven specific suggestions for Congressional action that have been sent to it, such as *the encouragement of land surveys, the establishment of highway engineering service* to be at the call of the States, and *the enlargement of the Bureau of Education*; it also groups remedies under the general term of *an educative compaign to spread information* on the whole subject of life, *to quicken the sense of responsibility for diversifying farming* so as to perserve soil fertility and improve rural society, *to make more widespread the belief in the necessity of organisation, to make more general the farmer's sense of responsibility for the welfare of the farm labourer*, and *to awaken among the people generally conscience in the protecting and developing natural scenery and the attractiveness of the open country*. There are, however, three great movements which the Commission calls fundamental. These are worthy of quotation in full :—

I. *Taking stock of country life.*—There should be organized as explained in the main report, under the Government leadership, a comprehensive plan for an exhaustive study or survey of all the conditions that surround the business of farming and the people who live in the country, in order to take stock of our resources and to supply the farmer with local knowledge. Federal and State governments, agricultural colleges and other educational agencies, organization of various types, and individual students of the problem, should be brought into co-operation for this great work of investigating with minute care all agricultural and country life conditions,

II. *Nationalized Extension Work.*—Each State college of agriculture should be empowered to organize as soon as practicable a complete department of college extension, so managed as to reach every person on the land in its State with both information and inspiration. The work should include such forms of extension teaching as lectures, bulletins, reading courses, correspondence courses, demonstration, and other means of reaching the people at home and their farms. It should be designed to forward not only the business of agriculture, but sanitation, education, home-making, and all interests of country life.

III. *A Campaign for rural progress.—We urge the holding of local, State, and even national conferences on rural progress,* designed to unite the interests of education, organization and religion into one forward movement for the rebuilding of country life. *Rural teachers, librarians, clergymen, editors, physicians, and others may well unite with farmers in studying and discussing the rural question in all its aspects.* We must in some way unite all institutions, all organizations, all individuals having any interest in country life into one great campaign for rural progress.

The Commission recognizes the great value of existing organizations such as libraries, agricultural societies, the Young Men's Christian Association, and, above all, the rural churches; and it urges the development of greater co-operation among them. It adds that there is a great call for leaders among farmers, rural teachers and the rural clergy. The report and the message ought to have the widest circulation, not only among the dwellers in the country, but even more especially among the people of the cities. It is the urban citizen who is in the greatest need of information on the subject; and he is in fact as much concerned with proper rural conditions as the man on the farm.

MARKET RATES FOR TROPICAL PRODUCTS.

(From Lewis & Peat's Monthly Prices Current, London, 10th November, 1909.)

	QUALITY.	QUOTATIONS.
ALOES, Socotrine cwt.	Fair to fine ...	85s a 90s
Zanzibar & Hepatic ,,	Common to good ..	40s a 70s
ARROWROOT (Natal) lb.	Fair to fine ..	4d a 5d
BEES' WAX, cwt.		
Zanzibar Yellow ,,	Slightly drossy to fair ...	£6 7s 6d a £6 10s
Bombay bleached ,,	Fair to good	£7 10s a £7 12s 6d
,, unbleached ,,	Dark to good genuine ..	£5 10s a £6 5s
Madagascar ,,	Dark to good palish	£6 7s 6d a £6 12/6
CAMPHOR, Japan ,,	Refined	1s 5¾d a 1s 7½d
China ,,	Fair average quality ...	135s
CARDAMOMS, Tuticorin	Good to fine bold	1s 10d a 2s 2d
	Middling lean	1s 7d a 1s 8d
Tellicherry	Good to fine bold ..	1s 9d a 2s
	Brownish ..	1s 3d a 1s 7d
	Med brown to fair bold	1s 10d a 2s 8d
Mangalore ,,	Small fair to fine plump	1s 6d a 2s 11d
Ceylon.—Mysore ,,	Fair to good ..	1s 4d a 1s 6d
Malabar ..	Fair to good ..	1s 8d a 1s 9d
Seeds, E. I. & Ceylon ,,	Shelly to good ..	6d a 1s 6d nom.
Ceylon Long Wild ,,	Good 2nds ..	3d
CASTOR OIL, Calcutta ,,	Dull to fine bright ...	35s a 40s
CHILLIES, Zanzibar cwt		
CINCHONA BARK.—lb.		
Ceylon	Crown, Renewed	3⅜d a 7d
	Org. Stem	2d a 6d
	Red Org. Stem	1¾d a 4¼d
	Renewed	3d a 5¼d
	Root	1⅜d a 4d
CINNAMON, Ceylon 1sts per lb.	Good to fine quill	10d a 1s 4d
2nds	,, ,,	9d a 1s 2d
3rds	,, ,,	7½d a 11½d
4ths	,, ,,	6½d a 9½d
Chips, &c..	Fair to fine bold	2⅝d a 3⅛d
CLOVES, Penang lb.	Dull to fine bright pkd.	11d a 1s 2d
Amboyna ..	Dull to fine	8d a 8¼d
Ceylon ..	,, ,,	7½d a 9d
Zanzibar	Fair and fine bright	4¾d a 5¼d
Stems ..	Fair	1½d
COFFEE		
Ceylon Plantation cwt.	Medium to Bold	65d a 100s
Native	Good ordinary	nominal
Liberian ,,	Fair to bold	43s a 55s
COCOA, Ceylon Plant. ,,	Special Marks	60s a 74s
	Red to good	54s a 59s
Native Estate ,,	Ordinary to red	38s a 54s 6d
Java and Celebes ,,	Small to good red	30s a 85s
COLOMBO ROOT ,,	Middling to good	15s a 17s 6d
CROTON SEEDS, sift. cwt.	Dull to fair	45s a 49s
CUBEBS ,,	Ord. stalky to good	80s a 90s
GINGER, Bengal, rough ,,	Fair	30s nom.
Calicut, Cut A ,,	Small to fine bold	60s a 85s
B & C ,,	Small and medium	52s a 60s
Cochin Rough ,,	Common to fine bold	38s a 42s
	Small and D's	37s 6d
Japan ,,	Unsplit	38s 6d
GUM AMMONIACUM ,,	Sm. blocky to fair clean	25s a 60s
ANIMI, Zanzibar	Pale and amber, str. srts.	£16 a £18 5s
	,, ,, little red	£13 a £15
	Bean and Pea size ditto	75s a £14 2s 6d
	Fair to good red sorts	£9 a £13 10s
	Med. & bold glassy sorts	£6 10s a £8 10s
Madagascar ,,	Fair to good palish ...	£4 a £8 15s
	,, ,, red ...	£4 a £7 10s
ARABIC E. I. & Aden ,,	Ordinary to good pale	25s a 32s 6d nom.
Turkey sorts ,,		29s a 45s
Ghatti ,,	Sorts to fine pale ...	20s a 42s 6d nom.
Kurrachee ,,	Reddish to good pale ...	20s a 30s ,,
Madras ,,	Dark to fine pale ...	15s a 25s ,,
ASSAFŒTIDA ,,	Clean fr. to gd. almonds	120s a 140s ,,
	com. stony to good block	15s a 100s ,,
KINO	Fair to fine bright	6d a 9d
MYRRH, picked cwt	Fair to fine pale	80s a 115s
Aden sorts ,,	Middling to good	55s a 65s
OLIBANUM, drop ,,	Good to fine white	40s a 50s
	Middling to fair	25s a 35s
pickings ,,	Low to good pale	6s 6d a 17s 6d
siftings ,,	Slightly foul to fine	13s a 15s
INDIA RUBBER lb.	Fine Para bis. & sheets	8s 11d
	,, Ceara ,, ,,	8s 4d
Ceylon, Straits, Malay Straits, etc.	Crepe ordinary to fine..	8s 4d a 9s
	Fine Block ..	9s 2d
	Scrap fair to fine ..	6s 4d a 6s 8d
Assam	[illegible]	5s 4d a 5s 8d
	Fair II to ord. red No. 1	4s 2d a 4s 10d
Rangoon	,, ,,	3s 2d a 3s 6d

	QUALITY.	QUOTATIONS
INDIARUBBER. (*Contd.*)		
Borneo	Common to good	1s 8d a 3s
Java	Good to fine red ..	2s 6d a 4s
Penang	Low white to prime red	2s a 3s
Mozambique	Fair to fine red ball ...	4s 3d a 5s 2d
	Sausage, fair to good ..	4s 2d a 5s 1d
Nyassaland	Fair to fine ball ...	3s 8d a 4s 8d
Madagascar	Fr to fine pinky & white	3s 2d a 4s
	Majunga & blk coated ..	2s 6d a 3s 2d
	Niggers, low to good ..	1s 6d a 3s 8d
New Guinea	Ordinary to fine ball ..	3s 2d a 4s 6d nom
INDIGO, E.I. Bengal	Shipping mid to gd violet	2s 10d a 3s 8d
	Consuming mid. to gd.	2s 6d a 2s 10d
	Ordinary to middling	2s 2d a 2s 5d
	Oudes Middling to fine	2s 6d a 2/8 nom.
	Mid. to good Kurpah	2s 2d a 2s 6d
	Low to ordinary	1s 6d a 2s
	Mid. to fine Madras	1s 5d a 2s 4d
MACE, Bombay & Penang per lb.	Pale reddish to fine	1s 11d a 2s 4d
	Ordinary to fair	1s 8d a 1s 10d
Java	,, ,, good pale	1s 7d a 2s
Bombay	Wild	4d a 5d
MYRABOLANES, cwt	UG and Coconada	5s a 5s 6d
Bombay ,,	Jubblepore	4s 9d a 5s 10½d
	Bhimlies	4s 9d a 6s 3d
	Rhajpore, &c.	4s 6d a 5s 3d
Bengal ,,	Calcutta	5s a 5s 6d
NUTMEGS— lb.	64's to 57's	1s 3d a 1s 6d
Bombay & Penang ,,	110's to 65's	4¾d a 1s 2d
	160's to 115's	4d a 4½d
NUTS, ARECA cwt.	Ordinary to fair fresh	14s a 16s
NUX VOMICA, Cochin	Ordinary to good	9s a 11s 6d
per cwt. Bengal	,, ,,	6s a 6s 6d
Madras	,, ,,	6s 3d a 8s
OIL OF ANISEED ,,	Fair merchantable	4s 6d
CASSIA ,,	According to analysis	3s 8d a 4s
LEMONGRASS ,,	Good flavour & colour	2d a 2¼d
NUTMEG ,,	Dingy to white	1½d a 1¾d
CINNAMON ,,	Ordinary to fair sweet	2¼d a 1s
CITRONELLE ,,	Bright & good flavour	11¾d a 1s 1d
ORCHELLA WEED—cwt		
Ceylon ,,	Mid. to fine not woody...	9s a 11s
Madagascar ,,	Fair ...	9s
PEPPER—(Black) lb.		
Alleppee & Tellicherry	Fair ...	3¾d a 4d
Ceylon	,, to fine bold heavy ..	3½d a 4d
Singapore ..	,, ...	4d
Acheen & W. C. Penang	Dull to fine	3½d a 3¾d
(White) Singapore ,,	Fair to fine	7d a 8d
Siam ,,	Fair	7d
Penang ,,	Fair	6¼d
PLUMBAGO, lump cwt.	Fair to fine bright bold	—
	Middling to good small	—
chips	Dull to fine bright ..	—
dust	Ordinary to fine bright	—
SAGO, Pearl, large ...	Dull to fine .. .	15s a 16s 6d
medium ..	,, ,,	14s a 15s
small ...	,, ,,	12s a 13s 6d
SEEDLAC cwt.	Ordinary to gd. soluble	50s a 65s
SENNA, Tinnevelly lb.	Good to fine bold green	4½d a 7d
	Fair greenish	3½d a 4d
	Common speck y and small	2d a 2¾d
SHELLS, M. o'PEARL—		
Egyptian cwt.	Small to bold ..	25s a 115s nom.
Bombay ,,	,, ..	21s a 115s
Mergui ,,	,, ,, ...	£8 a £8 15s
Manilla ,,	Fair to good ..	£5 12/6 a £10 10s
Banda ,,	Sorts	25s a 30s nom.
TAMARINDS, Calcutta...	Mid. to fine bl'k not stony	11s a 12s
per cwt. Madras	Stony and inferior ..	4s a 5s
TORTOISESHELL—		
Zanzibar, & Bombay lb.	Small to bold ..	8s a 31s
	Pickings .	3s a 18s 6d
TURMERIC, Bengal cwt.	Fair .	18s
Madras ,,	Finger fair to fine bold bright	17s a 18s
Do. ,,	Bulbs	14s a 15s
Cochin ,,	Finger .	15s
	Bulbs ..	13s 6d
VANILLOES— lb.		
Mauritius .. } 1sts	Gd crystallized 3½ a 8½ in	11s 6d a 18s
Madagascar ... } 2nds	Foxy & reddish 3½ a ,,	10s 6d a 14s
Seychelles .. } 3rds	Lean and inferior ...	10s 6d a 11s
VERMILLION ..	Fine, pure, bright .	3s 3d
WAX, Japan, squares	Good white hard ...	44s

THE SUPPLEMENT TO THE

Tropical Agriculturist and Magazine of the C. A. S.

COMPILED BY A. M. & J. FERGUSON.

No. 6.] DECEMBER, 1909. [VOL. V.

RUBBER IN THE BRITISH EMPIRE.

COUNTRIES OF ORIGIN.—India, Gambia, Sierra Leone, Gold Coast, Southern Nigoria, British East Africa, Zanzibar, Nyasaland, Rhodesia, Transvaal, Cape Colony, Seychelles, West Indies, British Guiana, Portuguose East Africa.

Number of rubbers receivod in 1908 ... 40
Number of rubbers reported on in 1908 ... 94

The attention which has been devoted to rubber and its cultivation during recent years in nearly all the tropical Colonies and Protectorates shows no sign of diminution, and the number of specimens reported on by the Imperial Institute during 1908 slightly exceeded the figures for 1907. In addition to the examination of samples of rubber much information and advice have been supplied to Colonial Governments, planters, and enquirers in this country on points connected with the cultivation of rubber-yielding plants or with the collection and preparation of rubber.

INDIA.—Specimens of Para, Castilloa, Ceara, and Ficus rubbers prepared in India were reported on during 1908.

Para rubber (*Hevea brasiliensis*). The specimens submitted for examination were prepared at the Government experimental gardens at

KULLAR AND BURLIAR, IN THE NILGIRI HILLS.

The rubber from both sources was very satisfactory in chemical composition, comparing favourably in this respect with plantation Para rubber from Ceylon, but it was rather deficient in strength. The specimen from Burliar was much lighter in colour than that from Kullar and was consequently valued at a higher price, the quotations being 5s 4d to 5s 5d per lb, and 5s to 5s 2d per lb. respectively, with plantation Para biscuits at 5s 3d to 5s 9d per lb.

Castilloa rubber (*Castilloa elastica*). Specimens of this rubber were also received from Kullar and Burliar. The rubber from Kullar was of inferior quality on account of the largo amount (32·5 per cent) of resin present. The trees from which the rubber was obtained were, however, only six years old, and it is probable that the quality of the rubber will improve as they become older. The specimen from Burliar contained much less resin than that from Kullar (about 13 per cent) and was greatly superior in physical properties. It was valued at 3s 6d to 3s 8d per lb in London with fine hard Para at 5s 1d per lb, whilst 3s 2d to 3s 4d per lb was quoted for the specimen from Kullar.

Ceara rubber (*Manihot Glaziovii*). A specimen of Ceara biscuit rubber from Kullar was of good quality, containing 82·5 per cent of caoutchouc and exhibiting very satisfactory physical properties. It was valued at 5s 6d per lb., with Para biscuits quoted at 5s. 3d. to 5s 9d per lb. A sample of Ceara rubber from South Arcot was much inferior in composition to the preceding specimen, containing only 73·7 per cent of caoutchouc and a high percentage of proteid. It was valued at 2s 5d per lb when fine hard Para stood at 3s 5½d per lb.

Ficus elastica rubber. Two specimens of this rubber, one in biscuit form and the other in scrap, were forwarded from Mukkie in the

KANOTH RANGE, NORTH MALABAR.

Both samples contained a large amount of resin and were somewhat deficient in elasticity and tenacity. The biscuit rubber, which was almost black, was valued at 2s 6d per lb and the reddish scrap rubber at 2s 11d per lb with fine hard Para at 3s 5½d per lb.

GAMBIA.—The investigation of the rubber of *Ficus Vogelii* from the Gambia has been continued, and during 1908 a small consignment was received for technical trial. The rubber was of resinous nature, containing from 30 to 35 per cent of resin, but as the result of trials by manufacturers it was found to be suitable for certain technical purposes. The washed rubber was valued at from 1s. 7d. to 1s. 11d. per lb., with fine hard Para quoted at 2s. 9d. por lb.

SIERRA LEONE.—Ten specimens of rubber from Sierra Leone were reported on during 1908; they included samples of Funtumia, Landolphia and Ficus rubbers. The Funtumia rubber was of good quality, the dry product containing 87 per cent. of caoutchouc, but the biscuits were of rather rough appearance. It was valued at 3s. per lb., with fine hard Para at 3s. 5½d. per lb.

A number of samples of Landolphia rubber were examined. The well-prepared rubber was found to be of good quality, containing nearly 90 per cent. of caoutchouc in the dry material, and it was valued at the same price as the preceding specimen of Funtumia rubber.

A specimen of rubber obtained from a species of Ficus was found to contain 37 per cent. of resin, and was therefore of inferior quality. It was very similar in composition to the *Ficus Vogelii* rubber from the Gambia, and would realise about the same price.

GOLD COAST.—A number of specimens of Funtumia and Landolphia rubbers from the Gold Coast were reported on during 1908.

A sample of *Funtumia elastica* rubber, coagulated by means of an infusion of the leaves of *Bauhinia reticulata*, was received from Ashanti. It was of good quality, containing 88·5 per cent of caoutchouc, but the sheets were of rather rough appearance and not thoroughly dried. It was valued at 2s 8d to 2s 10d per lb, with fine hard Para quoted at 3s 5½d per lb.

Three other specimens of Funtumia rubber from Ashanti had been prepared by "creaming" the latex. They were of very good quality so far as chemical composition is concerned, containing from 88·5 to 89 per cent of caoutchouc and low percentages of resin and proteid. The commercial value of the samples was, however, reduced by the facts that the cakes had been made too thick and contained a considerable amount of moisture; they were also of rather rough appearance. The specimens were valued at from 2s 7d to 2s 10d per lb with fine hard Para at 4s 6d per lb. A fifth sample of Funtumia

RUBBER FROM ASHANTI

had been prepared in biscuits by the spontaneous coagulation of the latex. It was much less satisfactory in chemical composition than the preceding specimens, containing only 71·5 per cent of caoutchouc and large amounts of resin and proteid. It was however much superior in appearance, and was valued at 3s 6d to 3s 8d per lb with fine hard Para quoted at 4s 6d per lb.

A specimen of "Pempeneh" rubber, derived from *Landolphia owariensis* growing in the Northern Territories, was found to be of very good quality, containing 90·6 per cent of caoutchouc, 6 per cent of resin, and less than 1 per cent of proteid. It was valued at 3s to 3s 3d per lb with fine hard Para at 3s 5½d per lb.

Six specimens of latex and two samples of Ficus rubber received from an estate near Axim were examined. The Ficus rubbers contained 22 and 27 per cent. of resin, and were therefore of inferior quality. Samples of Ficus latex which were stated to correspond to the specimens of prepared rubber were found to yield products of similar character. A specimen of Landolphia latex, probably from *L. owariensis*, yielded rubber of good quality, but the other latices, stated to be derived from species of Landolphia, Tabernæmontana, and Anthostema, and from *Funtumia africana*, furnished resinous products of no commercial value.

A substance resembling gutta percha, derived from the rhizomes of a plant occurring in the Colony, was also investigated.

SOUTHERN NIGERIA.—A number of specimens of *Funtumia elastica* rubber prepared in biscuits or sheets have been received for examination and valuation in comparison with the ordinary lump rubber as prepared by the natives. One sample, described as

"ANYO" RUBBER,

was in the form of dark-coloured biscuits which had been imperfectly dried, and consequently arrived in a mouldy condition. The rubber was of good quality, containing 86·5 per cent of caoutchouc, and was valued at 2s 6d to 2s 8d per lb., with fine hard Para quoted at 3s 5½d per lb. Samples of Benin lump rubber sent at the same time were valued at from 1s 6d to 1s 11d per lb.

Three further samples of Funtumia rubber in biscuit form were forwarded from Benin City. They were of satisfactory composition, containing from 87·9 to 89·8 per cent of caoutchouc, but were of very rough appearance. They were valued at from 2s 8d to 3s 4d per lb, with fine hard Para at 4s 6d per lb., and

BENIN LUMP AT 2S PER LB.

A specimen of "Ubabikpan" rubber derived from *Clitandra elastica* was found to be of very good quality, containing 90 4 per cent of caoutchouc whilst the percentages of resin and proteid were low. It was valued at 2s 8d to 2s 10d per lb, with fine hard Para at 3s 5½d per lb.

A sample of rubber derived from the Marodi vine consisted of a thick rough biscuit of brown rubber, dry and well prepared. It contained over 80 per cent. of caoutchouc, but a rather large amount of proteid. It was valued at 2s 6d per lb., with fine hard Para at 3s 1d per lb.

A specimen of rubber believed to have been prepared from *Ficus Elastica* was found to be very satisfactory in chemical composition, but deficient in physical properties. On the later account its commercial value was only law.

EAST AFRICA PROTECTORATE.—The examination of a small ball of Ceara rubber from the Kibos district showed that the percentages of resin, proteids and insoluble matter were all rather excessive. It was valued at about 3s per lb., with fine hard Para at 4s 3½d per lb.

ZANZIBAR.—Small samples of Para and Castilloa rubbers experimentally prepared in Zanzibar were received for examination.

The Para rubber was of very good quality but contained a fair amount of vegetable impurity and a little more resin than usual.

The Castilloa rubber was of very resinous nature containing only 77 per cent. of caoutchouc and 20·5 per cent. of resin. No information was available as to the age of the trees from which the specimen was obtained. The samples were too small for valuation.

CAPE COLONY.—A specimen of coagulated latex received from Cape Colony was found to contain 64 per cent of resin, and would therefore have very little, if any, commercial value. It was probably derived from a species of Euphorbia.

RHODESIA.—A sample of Ceara rubber from North Eastern Rhodesia proved to be of inferior quality on account of the large percentage of sand which it contained; otherwise it was of normal composition. It was valued at 1s 8d per lb., with fine hard Para at 3s 5½d per lb.

A specimen of so-called rubber was also received from Southern Rhodesia. It proved to be a resinous product, resembling the material obtained from species of Euphorbia in South Africa.

SEYCHELLES.—Specimens of Para and Vahea rubber were received from Seychelles for examination.

The three samples of Para rubber were obtained from a small number of trees under five years old, but of considerable size. The rubber was very satisfactory in composition, comparing favourably in this respect with Para rubber from Ceylon and tbe Federated Malay States, but was deficient in strength. The latter defect was probably chiefly due to the fact that the rubber bad been obtained from young trees. From the results of tbe chemical examination however there appears to be every likelihood that the Para trees in Seychelles will yield excellent rubber as they become older.

The Vahea rubber, derived from a climbing plant introduced from Madagascar, was of good quality, the best specimen containing 91 per cent of caoutchouc, but the cost of preparing the rubber in a clean form is practically prohibitive.

JAMAICA.—A sample of the rubber of *Forstcronia floribunda*, a climbing plant occurring in Jamaica, was found to be of good quality, containing 88·8 per cent. of caoutchouc. It was valued at 2s 4d per lb., with fine hard Para at 3s 5½d per lb.

BRITISH GUIANA.—The rubber obtained from *Sapium Jenmani* in British Guiana has been carefully investigated in order to determine its composition and value. A number of specimens in the form of biscuits, scrap block, and ball, have been analysed, and the results show that the rubber is of very good quality so far as chemical composition is concerned. The percentages of caoutchouc recorded range from 87 to 92 per cent and of resin from 2·0 to 4·2 per cent; tbe best specimen contained 92·4 per cent of caoutchouc, 2 per cent of resin and 2·8 per cent of proteid. The following valuations were obtained: scrap block from 2s 4d to 3s per lb; balls 2s 6d per lb.; and the best biscuits 3s 6d per lb, with fine hard Para at 3s 5½d per lb. There is therefore no longer any doubt tbat the rubber yielded by this tree is of excellent quality if carefully prepared.

A sample of Balata from British Guiana was of very good quality, containing 50·7 per cent of gutta and 44·8 per cent of resin. The percentage of gutta is higher than that usually recorded for balata. The specimen was valued at 2s 2½d per lb. The latex of the Bastard Bullet tree was found to yield a product containing 70·6 per cent of resin, therefore differing widely in composition from true balata.

PORTUGUESE EAST AFRICA.—Specimens of Ceara, Landolphia, and Mascarenhasia rubber from Portuguese East Africa proved to be of good quality, whilst the products obtained from *Ficus* sp., *Landolphia florida* and *Diplorrhynchus mossambicensis* were of resinous nature and of little or no value

An examination has also been made of Bitinga tubers (*Raphionacme utilis*) and the rubber they furnish. The partly dried tubers as received contained from 1·0 to 1·5 per cent of rubber, corresponding to a yield of 9·3 to 11·6 per cent from the dry material. The sample of prepared rubber was of very fair quality, but was rather sticky and contained a considerable amount of vegetable and mineral impurity. Trials are being made to ascertain whether the tubers of this plant, which is stated to flourish on poor soils not adapted to otber rubber plants, can be profitably utilised as a source of rubber.—*Imperial Institute Report for 1908.*

ECANDA RUBBER.

(*Raphionacme utilis*, Brown & Stapf.)

In the *Kew Bulletin*, 1908, pp. 209-215, and pp. 305-307, an account has been given of *Raphionacme utilis*, Brown & Stapf, and of the rubber prepared from its tubers. Since these accounts were published Mr. John T. Norman, of the City Central Laboratory, London, E. C., has sent

A FURTHER CONSIGNMENT OF THE TUBERS

of the Ecanda rubber plant, which were brought over from Angola by his client, Mr. J. Neale May.

Mr. May holds a large concession of land near Bihe, Angola, wbere *Raphionacme utilis* grows in abundance, and he has kindly furnished particulars as to the mode of growth of the plants under natural conditions and of the country in which they are to be found. From this information the following account has been written.

The tubers of Ecanda rubber recently received at the Royal Botanic Gardens came from a plateau near Bihe, in about 17° E. long. and 12·5-13° S. lat.,

AT AN ELEVATION OF 5,000 FEET ABOVE SEA LEVEL.

This plateau, which forms the concession, occupies an area of some 25 sq. miles, an slopes away fairly steeply towards the east and west, forming the divide between two river systems. The plant though found in considerable quantity in the region generally, does not appear to flourish in other places so well as on the plateau.

The plateau is crossed by the main route from Benguella to Lake Tanganyika and is distant from the port of Benguella some 420 miles by wagon road. The distance across country to the port by bush paths is much shorter and occupies about twenty days, as the wagon road makes a considerable détour to the south in order to cross certain mines. In fine weather the journey by wagon road can be made in abou 30 days,

The climate is fairly damp and rain falls during five or six months of the year. The rainy season commences about January; heavy rains are not frequent, but the rains are more like those of England, and there is a considerable amount of damp mist. During the dry season no rain ever falls, but mists and heavy dews prevail at night-time. In the wet season the rivers rise about 20 ft. and fall some 2-3 ft. below their normal level in the dry season. The soil of the plateau is

A DEEP AND VERY SANDY LOAM.

sandy loam of finely divided, clean black earth four or more feet in depth. This soil retains moisture readily though it never cakes or runs together; it is always very warm beneath the surface, giving the impression that fermentation is proceeding. It is possible to dig a hole with a stick to a depth of three or four feet as in sand.

The plateau is covered with a very fine grass, growing to a height of not more than 2 ft., and the *Raphionacme* plants are found growing plentifully among the grass. Off the concession (plateau) the growth of the grass is very rank and coarse, some 6 to 7 ft. high, and is almost impossible to penetrate.

The plants grow with the leaves closely pressed to the surface of the ground, forming a kind of rosette after the manner of plantains on a lawn. The tubers usually occur buried just below the surface of the soil, and may be shaped either like a turnip or peg-top, or may be very broadly napiform to discoid. They produce from 1 to 3 leafy shoots, each bearing 4 to 6 pairs of leaves, and as a rule only one of the shoots produces an inflorescence. The shoots are quite short but in old plants the inflorescence may be born on a longer stalk about 2 ins. in length. Unless burnt by bush fires it appears that the leaves remain green, and the tubers continue to grow throughout the year. Of the tubers sent to Kew by Mr Norman, the discoid ones were the larger, and one of the specimens weighed 2 lb. 5 oz. Mr May, however, states that a large number of the

TUBERS WEIGH FROM 4—5 LBS.

and he has found a specimen weighing as much as 15 lb. It seems probable that there may be more than one species of *Raphionacme* growing on the plateau, but whether the tubers of different shapes belong to different species cannot yet be determined. An inflorescence borne by one of the discoid tubers proves this plant to be *Raphionacme utilis*, though in the general shape and colour of the leaves it differed somewhat from the plant already described (K. B., 1908, p. 215, and *Bot. Mag.* tab. 8221). Mr May is inclined to believe that there are probably five or six different kinds of rubber-yielding tubers. One kind in particular bears a much larger tuber than the true Ecanda plant, and has finely cut leaves "like a tuft of grass." In this plant the skin or rind of the tuber is coarse like the bark of a tree, and the

LATEX OCCURS ONLY IN THE RIND.

In shape and size the tubers resemble a rugby football. In the Ecanda plants the veins of the leaves may or may not be purple on the underside.

The flowers of *R. utilis* have already been described, but those of Mr May's plant were of a deep claret colour and borne in a terminal cluster.

The plants usually flower on the plateau in November and early December, the driest time of the year, and the seed is ripened at about the end of December, just before the commencement of the rainy season. Seed is produced in quantity but it tends to be destroyed in great part as the natives burn off the grass among which the plants are growing just before the rainy season sets in.

THE COLLECTION OF THE SEED

is difficult and to trade costs in goods the equivalent of about

£4 PER OZ.

The tubers are collected by the natives on the plateau in the following manner. The fine grass and general vegetation covering the country is set on fire and the tubers, which can then be easily seen, are hoed up and brought to head-quarters in baskets. Large and small tubers are gathered indiscriminately, but the contents of the baskets are weighed and sorted, and only those of large size are kept for the production of the rubber. The two illustrations from photographs, taken by Mr May on the concession plateau, shew a quantity of the Ecanda tubers brought in by the natives for the extraction of the rubber. The smaller ones are thrown aside, and as they are not materially damaged by the burning of the grass, they are replanted and commence to grow again quite readily.

No attempt at the cultivation or clearing of the ground has been attempted, nor have any experiments been made with the sowing of seed. In replanting the smaller tubers a hole is simply dug in the earth amongst the grass with a native hoe and the tuber is planted and

LEFT TO GROW UNTENDED.

As to the rate of growth of the tubers, it is unfortunate that at present we have no reliable information. According to Professor Geraldes (*K.B.*, 1908, p. 214) the plants are biennial (?), and one-year old plants are stated to be about 3-4 ins. in diameter, and to weigh from 7-10½ ozs. Mr May has not made any careful observation but is of the opinion, however, that a three-year old root would weigh about 6 ozs. As the natives always burn the long grass once a year in order to obtain fresh herbage, he thinks that these fires may possibly check the growth of any tubers over which they pass. We have been informed that the yield of tubers, on an experimental plantation in a neighbouring region, at a minimum estimate is likely to be 8 tons, and that there is every prospect that a yield of about 12 tons per acre will be realised.

SEEDLINGS OF RAPHIONACME UTILIS.

In connection with the question of the rate of growth of the Ecanda plant the behaviour of some seedlings raised in the Royal Botanic Gardens, Kew, is of some interest. At the end of Dec. 1908, a parcel of Ecanda seed was received from the Anglo-Angolese Trading Co., Benguella, 9, Billiter Street, London, E.C., with the following note: "Seeds of the Ecanda tuber, called also 'Vitinga' or 'B'tinga' plant by the Angolese

from the district of M' Bongo, Serra Andrade Corvo, South Angola between 12° 50' and 14° S. lat. and 14° 40' and 15° 20' E. long.; altitude given as between 1,200 and 1,500 m." Some of these seeds were distributed to various suitable Botanic Gardens and some were sown at Kew, on the 2nd January of this year. The seeds germinated quickly and developed two cotyledons with petioles nearly 1 cm. in length; the laminæ are oblong-obovate obtuse, glabrous and slightly fleshy.

The plumule usually develops with an elongated first internode, about 1 cm. in length, the subsequent internodes being short. The internodes are delicately hairy with short glandular hairs. The plumular leaves, which show a decussate arrangement, are more or less ovate, glandular, and have a well-marked mid rib. In the course of two months the young shoot has reached the stage shewn in Fig. 1, and at the end of seven months the seedlings have grown to the size shewn in Figs. 2 and 3.

At the end of two months the tap root had swollen to form an elongated fusiform tuber 1 cm. long by about 2 mm. in diameter, and during this time it is pulled deeper into the soil by the action of root shortening. The tuberous root in the largest example, Fig. 3, is some 4·5 cm. in length and 9 mm. in diameter.

Some seeds were also received at Kew from the Botanic Gardens, Dahlem, Berlin, under the name of *Nitinga rosea* in August, 1908, which germinated, and it is now possible to recognize that the young plants are probably seedlings of *Raphionacme utilis*, the name *Nitinga* being apparently a corruption of the native name B'tinga or Vitinga.

These latter plants, now a year old, have a single shoot which has grown continuously and is about 3 cm. long with five pairs of leaves crowded towards the shoot apex. The tuber which is becoming more globular measures 1·5 cm. in diameter. Although Mr. May is of the opinion that the Ecanda plants grow more quickly in Angola than they do at Kew it appears clear that the *Raphionacme* is not a biennial plant as was at first suggested.

In the Bulletin of the Imperial Institute, vol. vi., 1908, pp. 390-393, a short account of the analysis of the tubers of the *Bitinga* rubber plant is given, derived from specimens received from the Mozambique Company.—*Kew Bulletin*, Nov 8, 1908.

RUBBER IN SOUTH COORG.

Pollibetta, Oct. 16.—Mr. Alexander, who for many years was a planter in this District, but who has lately been in England, has come out to open up land and plant Para rubber below the Sampagi Ghaut, on the way to Mangalore, at an elevation of 800 ft. above sea-level, for Messrs. Chisholm and Morris, the former of South Coorg and the latter of Chamrajnagar, Mysore. It has been arranged to plant up 250 acres next season. At this low elevation, with an assured heavy rainfall, it is probable that Para will prove a success. The land to be opened lies inside the Coorg border.—*M. Mail.*

RUBBER IN BRAZIL.

Mr. Cheetham (Secretary to the British Legation at Rio de Janeiro), in his report on the trade of Brazil for the year 1908, contributes a valuable and interesting statement on the rubber industry in that country. He says the rubber trade of the Amazon Valley is in many respects one of the most remarkable commercial movements in existence. If the value of the product put on the world's markets be compared with the trifling expenditure of human energy involved in its collection the contrast is an extraordinary one. The whole of this valuable trade, in the first place, is

GATHERED BY A HANDFUL OF ILLITERATE, UNTRAINED MEN,

who taking their lives in their hands, enter the vast uncultivated wilderness of the Upper Amazon forests and, on behalf of distant aviadores and nominal forest owners, tap the trees and smoke the rubber that later on figures as the second asset in Brazilian commercial and financial prosperity. Deprived of her rubber output Brazil would lose one-third of her purchasing capacity. Yet, Mr. Cheetham states, although the source of so large a part of her national income, Brazil as a whole does nothing for her rubber producers, and these, in equal disregard of great responsibilities, do little or nothing for their rubber trees. The whole of the vast wealth of the Amazon rubber output is drawn from the virgin wealth of uncultivated forest products, the product being obtained by the crudest methods from the natural wilderness of rubber-giving trees.

Were the rubber industry of the Amazon Valley, Mr Cheetham adds, established on organised lines of cultivation and scientific development, the number of persons actively employed in rubber production (now officially and inaccurately given as 5,337) would be one of many hundreds of thousands. But

THE METHODS OF PRODUCTION

have shown no advance during a period of 12 years, while the cost of production must have greatly increased. That Para rubber, he continues, as it is today exploited can continue successfully to compete when once the East India plantations have attained a large area of development seems highly improbable. The cost of the bare necessities of life, to say nothing of the comforts of existence, has greatly increased, and the absence of these things renders the weary lot of the Amazon rubber extractor one of the most depressing in existence. Half submerged in a swampy forest, he has few or no companions and no social life at all. A stranger from far away, he makes no home, but squats where be can best tap the surrounding trees. The owner of the estate neither resides on it nor pays an absentee tax. His ownership restricts itself to taking out papers of registration before someone else has obtained them, and then leasing the right to find and tap what rubber trees the undefined vagueness of this "estate" may afford the hardy Ceará or Maranhao explorer who acts as his tenant. There is little likelihood of Amazon rubber

being exhausted. The area is so vast, the supply of trees so constantly self-renewing, that it is most improbable that while demand continues and profitable prices are obtained the supply from this region will fall off. The

REAL DANGER TO THE AMAZON INDUSTRY LIES IN THE COMPETITION OF CULTIVATED RUBBER.

If this can be shortly produced on a large scale, and the demand does not keep equal pace, prices must fall.

The Amazon forest on the present lines of Brazilian taxation and expenditure

CAN ONLY BE WORKED IF THE PRICE OF RUBBER REMAINS HIGH.

The expenses are so great, the taxes imposed so onerous, that any permanent fall in the price of rubber would mean not alone the cessation of Amazon rubber production, but a very serious financial problem for the whole of Brazil to meet. Rubber cultivation in Ceylon, the Malay Peninsula, and, no doubt, elsewhere, can be profitably carried out, and by annually improving the methods, at a rate of expenditure that would be wholly insufficient to tap the wild forest trees of the Amazon basin. Considerations such as these, while they should stimulate rubber production within the British Empire, should not be lost sight of (Mr. Cheetham points out) by those who may be disposed to invest money in the purchase and exploitation of so called rubber estates on the Amazon. The excessive import duties and the heavy export taxes must never be lost sight of; for they affect every aspect of commercial, industrial and individual life in Brazil. While it may be held as unquestionable that Amazon rubber is a wild product obtained by the least expenditure of labour necessary to its crude production, and with no resort to cultivation, there is a growing export from other parts of Brazil of inferior kinds of rubber which may in the near future attain large proportions. This rubber, moreover, is to some extent the product of cultivation.

THE FOUR VARIETIES OF AMAZON, OR WILD, RUBBER

are known by the trade designations of Seringa fina, Seringa entre-fina, Seringa Sernamby, and Seringa Caucho. These, the overwhelming bulk as they are of the more valuable varieties of Brazilian rubber, are all found only in the Amazon regions. In five years the quantity of these inferior kinds of rubber shipped from Brazil has more than doubled, and it is probable that with the largely increased demand and higher prices which have ruled throughout the last six or seven months the export of these lower grades of rubber will show a considerable development in the course of the present year.

The improvement in price that began to affect the rubber trade in the closing months of 1908 has continued its upward tendency, as Mr Cheetham mentions, during the first months of 1909, and the returns for the first four months of the present year show a very marked gain in price and also an increase of bulk shipped. From January to April, 1908, the total shipments of all kinds of Brazilian rubber were as follow:—

January to April—	tons, Met.	£
1908 ...	.. 16,265	4,279,699
1909 ..	.. 17,179	6,902,243

These figures will probably show a still more remarkable development in favour of the current year on the completed six months up to June 30, 1909, the quantity shipped in May having amounted to 2,698 tons, according to a moderate local estimate. The figures for June were:

	Met. tons.	£
1908	3,297	843,438
1909	3,883	1,550,070

Compared with coffee, the principle article of Brazilian export trade, rubber now comes in a fairly close second. For the few months Jan. to April, 1908, coffee was exported to the value of £8,413,763. It is possible that on the first half-year's trade rubber may present an export value equal to that of the leading article of Brazilian external commerce and the returns for the whole year 1909, if the present high prices should continue, may even put rubber in the first place of all Brazilian exports.

In the year 1908 the export of rubber from the Amazon Valley diminished, but this was due to fall in prices during that year, and not to fall in bulk.—*H. and C. Mail*, Oct. 15.

A RUBBER SHRUB IN CHILE.

The United States consul at Valparaiso reports concerning the *Euphorbia lactiflua*, a rubber shrub discovered by the botanical section of the national museum of Chile:

"A very good quality of rubber can, it is claimed, be easily made from this shrub, which is found on the mountains and table lands of that portion of the interior of Chile extending from Taltal south to Caldera, a distance of about 75 miles. It is said to bo of no other use than for rubbor and wood pulp. It is claimed that extracting the sap just does not injure the plant, dustry if attention be given to its cultivation. It is badly scattered and in many cases difficult of access, but it is claimed that it could easily be cultivated. A company has been organised to dovelop the industry, and is seeking a concession."—*India Rubber World*, Oct. 1.

GUAYULE RUBBER.

AND THE U. S. A. $30,000,000 COMBINE.

Reuter's telegram, published in our issue of Saturday last, reporting the amalgamation of two great American Rubber Companies—the Continental and the Inter-Continental—is interesting. Mr. William H. Stayton, the President of the Continontal Rubber Company (which has a capital of $30,000,000), resigned recently, after being with the Company for a long time, as he is organising a new Rubber Company in Texas to take over certain very large concessions of guayule rubber lands in various countries of Texas. Mr. Stayton has declined to make public any statement beyond the fact that his new concern will be known as

THE BIG BEND RUBBER COMPANY;

but the severance of his connection with the Continental and the knowledge of his future plans have revived interest in guayule rubber, the output of which is expected to be largely increased as a consequence of the above gentleman's

work in its behalf. The record prices prevailing for rubber have stimulated the demand for guayule, which is used by manufacturers of mechanical rubber goods, such as matting, tiling, etc. In present circumstances manufacturers want a cheaper ingredient than Para, and they appear to favour guayule, which costs, say, 2s. 1d. per lb. when Para prices are in the neighbourhood of 9s.

Guayule, as many of our readers are aware, is a shrub. It grows on the sides of the otherwise bare hills of Texas and Mexico and from it, by a mechanical process, there is extracted about 12 per cent. of guayule rubber. Already, the imports from Mexico into the United States amount to above 15,000,000 lb. in the year. It has been asserted that the Texas shrub will not yield as large a percentage of caoutchouc as the Mexican, but Mr Stayton has no doubt made careful estimates as to the prospect of reaping advantage from his new enterprise. One difficulty is that in the production of the rubber the shrub is destroyed, and the question of reproduction is one about which conflicting opinions are held. Some men claim that the shrubs they are now using are fifty years old, and that this time will be necessary for reproduction; others even question if the plant will reproduce itself; yet others hold that under cultivation guayule would yield a very much lower percentage of rubber than is obtained from the wild shrub. Perhaps, Mr. Stayton will be in a position later on to throw light on these points.—*M. Mail,* Nov. 8.

A NEW RUBBER PLANT.

"ASCLEPIAS STELLIFERA," SCHLECHT.

Towards the latter end of last year herbarium specimens of a plant, with a small sample of rubber extracted from it by maceration, were received from Mr. J Burtt Davy, Department of Agriculture, Transvaal. The sample of rubber was prepared by Mr. J Ivens Ferraz, Official Translator to the High Commissioner of the Transvaal, but was too small to admit of a commercial valuation being placed upon it; the herbarium material, however, was sufficiently complete to allow of its botanical origin being satisfactorily determined.

Asclepias stellifera is a native of South Africa, growing from 3 to 10 ins. high, and, according to *Flora Capensis,* is found in the coast region at an altitude of 3,500 to 4,000 ft., in the Kalahari region at 4,000 to 6,000 ft., and in the Eastern region at 3,500 to 4,500 ft.

The rubber is yielded by the root, which is stated to be very long and perennial. The plant has been found in hard ground on the veld, struggling with all sorts of weeds, but thriving better where no other plants existed.

Upon comparing the specimens of the plant sent with material in the Herbarium, Mr. N E Brown found that in the tissues of a root-stock of a dried specimen collected 46 years ago, the rubber contained in them was quite as elastic as in the recently-collected material. Mr. Brown also points out that as there are several other species of *Asclepias* with much the same habit as the plant in question, it is just possible that some of them may also contain rubber, but in most cases the root-stocks are wanting in the herbarium specimens. Subsequently nine larger samples of the rubber were received from the same source, and though few details bearing upon the varied methods adopted to bring about coagulation accompanied the samples, they were submitted for opinion to Messrs. Hecht Levis & Kahn, the well-known rubber experts, who found only one sample, which had been obtained from incisions without further treatment, to be worthy of serious consideration. This sample was found to be rubber of good quality and would probably have realised at the time (14.4.09) about 4s. 6d. per lb.—J.M.H.—*Kew Bulletin, No. 8, 1909.*

RUBBER FROM THE BANANA.

If what Mr Geo. C Benson, of Georgetown, Demerara, says proves correct, there is a very good time before the fortunate owners of Banana plantations, but some practical demonstration will probably be required before it will be generally conceded that one Banana tree will yield from 5 to 7lb. of marketable rubber. By the way, good rubber is worth from 7/- to 8/- a pound in London today. Writing to the Demerara *Chronicle*, on 6th Aug., Mr Benson says:—

"To dispel all doubt as to whether or not the banana is a rubber-producing plant let the following simple plan be followed: Cut one of the lower branches of a banana tree near the trunk, and then let the falling juice drip either into a wine-glass or into an egg-cup till it is about half full; then let either the wine-glass or the egg-cup stand for about six hours, after which moisten the fingers and take off the film that has formed on the top of the juice. If the fingers are moist or wet, the film can be pressed and rubbed between the fingers, and then a beautiful and pink-like ball of very soft rubber will be the result."- I am, Sir, etc., GEORGE C. BENSON.

Lot 102, Carmichael Street, Georgetown, Aug. 6th, 1909.

Mr Benson sends the *Chronicle* the following:

"One mature banana tree will give from 5 to 7lb. of marketable rubber when it is properly admixed. The rubber is fully worth 60cts. per lb. All that the former now gets is about 20cts. per bunch for his plantains or bananas."

		$
6 lb. of rubber at 60 cts.	..	3·60
1 Bunch of bananas	..	·16
		3·76
Less cost of admixing 6 lb. of rubber about	..	·36 ?
Estimates about	..	3·40

It would be interesting to hear what Mr J B Carruthers has to say with regard to this.—*Proceedings of the Agricultural Society of Trinidad and Tobago*, Sept., 1909.

RUBBER IN PATANI, SIAM.

Mr Vice-Consul Wood, in his report for 1908, says: Patani is now the only purely Malay State remaining under Siamese rule. The British subjects probably number about 300, mostly natives of India. The only foreign-owned rubber plantation in Patani is near Banguara. It is owned by an Englishman, and was started about four years ago. Reports with regard to it are favourable. I venture to call the attention of persons interested in rubber to the possibilities of Patani as a rubber-producing country. —*L. & C. Express*, Sept. 24.

PARA SEED AND BAMBOO POTS.

The following is a letter, dated 7th May, 1909, from Mr. Ridley, Director of the Botanic Gardens, Singapore, to Mr. Craig:—

"I am sorry you had so poor a result from the rubber seeds. The season is over now, and no more will be procurable for some months, but when they are we can send you some to make up. Are you sure you planted them right, soaked in water for a day, and not planted beneath ground? *Do not use* bamboo pots in future. It is never satisfactory and very rarely indeed requisite. I know it is often done, but I have seen very bad results from it. Plant in a bed, and move the young plants out when ready, you cannot properly water seeds in a bamboo pot. We never use them at all for anything."—*Journal of the Jamica Agricultural Society*, Sept., 1909.

COCONUT DISEASE IN JAMAICA.

While he was in the west end, Mr Cradwick carried through some experiments in spraying coconut trees with Bordeaux Mixture, and he is still following up the disease in the east end. Because we have bud rot disease here, people must not run away with the idea that all coconut trees that die, apparently from the top, have died from bud rot disease. Many coconut trees die through unsuitable soil conditions, not only through lack of drainage, but sometimes through poverty of soil; and when the roots become diseased, as the coconut grows from the cabbage or bud, the growing point becomes unhealthy also. The lowest leaves then yellow and droop, and decay, the bud or cabbage becomes more diseased, more and more leaves decay, until only one or two of the latest leaves are left green and then soon follow the others. The yellowing of the leaves, however, is not always a sign of disease; continued drought might cause the leaves to yellow, a poor or undrained soil might have the same effect. It is always a safe plan, if there is no continued drought, and the young leaves are seen to be withering more than would happen ordinarily to send a boy up to examine the cabbage. If this part is diseased it tells in the smell. If taken in time the cabbage may be treated with Bordeaux Mixture, which is made of sulphate of copper and lime. The usual way, and an effective way of treating all diseases that affect the top of a coconut tree is to burn the trash and so scorch the top. This, curiously enough, does not kill the tree, though if the burn is too severe it does—but of course it may take a year or so for the tree to recover and begin bearing again. But the burning cures the bud rot.

The true bud rot disease is now supposed to be a bacterial disease, and the spores are carried by the wind, but we think the same rule applies as with all other plants and animals, too, that the disease does not readily attack perfectly healthy trees, because then all coconut trees would be liable to be attacked and die. The bacteria is probably only able to take effect on trees that are already unhealthy, through some unfavourable conditions. So that while trees may not die out entirely through lack of drainage or poverty of soil, these drawbacks may cause in them such weakness as to lay them open to the action of the bacteria of bud rot.

The first item to look at by those who have coconut trees is that the drainage is good, and that any trees that are standing in poor soil get A DOSE OF GOOD MANURE TO STIMULATE THEM. We have in mind a number of coconut trees, everyone was apparently about to die out; the leaves yellowed and dropped so much that there was only a tuft left at the top. As the soil was gravelly and the drought was severe, it was evident that there was no lack of drainage. The cabbage too had not gone wrong. As the trees were worth saving, the grass was clean weeded around them and cows tethered to each tree as the most convenient way of conserving manure and moisture. Of course all the trees were not done at one time, and this method could not be so easily carried through on a very large estate. The cattle were hand-fed, and after being a week at each tree the ground was loosened up and mulched. The effects were marvellous—there was soon no sign of disease about the trees, they put out fresh leaves and soon bore and bore well every time. Even though the cabbage may rot, the trouble may not always be *the* bud rot disease. The true bud rot is a very serious trouble, and one prominent coconut grower thought so seriously of it, that he asked the Society to recommend to the Government the compulsory burning of all dead coconut trees. All coconut growers in their own interests, should never allow a dead coconut tree to stand rotting, as these trees soon become the home of pests of various kinds.—*Journal of the Jamaica Agricultural Society*, for September.

COCONUT DISEASE IN SOUTHERN SEA

Following the appearance of an interview in our issue of March 23rd last, with Mr Geo. Compère, the West Australian Entomologist, in which he mentioned a new Coconut Pest in "New Guinea," the Secretary, Ceylon Agricultural Society, corresponded on the subject with the Director of Agriculture in the British territory and eventually (after some reference back) received the following reply:—

Territory of Papua, Department of Agriculture, Port Moresby, 13th September, 1909.

The Secretary, Ceylon Agricultural Society, Colombo.

Sir,—I have the honour to acknowledge the receipt of your letter No. 1757 of the 19th July last, enclosing a newspaper cutting containing the remarks of Mr Compere regarding an alleged plant-louse disease which he had heard was killing the coconut trees on "one of the New Guinea Islands." So far as the British portion of New Guinea is concerned I have no hesitation in saying that the statement is devoid of all foundation. We have an estimated area of 3?5,000 acres of native-owned and plantation coconut trees, and I have never seen or heard of a single tree in the territory having been killed by disease. Enquiries from planters and others have failed to reveal the slightest trace of the disease mentioned by Mr Compere.—I have the honour to be, Sir, your obedient servant, (Sgd.)

STANIFORTH SMITH, Director of Agriculture.

The following was the reference to the matter in our interview with Mr Compere:—

When he was in the East, Mr Compere heard from a large copra merchant that in one of the New Guinea Islands the coconut plantations were being gradually destroyed by a plant louse which attacked the tree and killed it. Mr Compere did not personally see the devastations, but he had no reason to hesitate in accepting what his informant told him. However, he simply gave the information on hearsay, but he thought that as Ceylon was a coconut-producing country, those interested might make enquiries and be prepared in case the danger ever appears in Ceylon.

CACAO INDUSTRY OF ECUADOR.

Consul-General Herman R Dietrich, of Guayaquil, reports that 41,747,587 pounds of cocoa were received at that port during the six months ended June 30, 1909, being 6,619,176 pounds more than the receipts during the first six months of 1908. The average price of the 1909 receipts was 10¼ cents a pound, making the half year's crop worth $4,383,497, which must have been very satisfactory to the producers.—*Tea & Coffee Trade Journal* for Oct., 1909.

"THE GRAFTING OF CACAO."

[Review By J. H. Hart, F.L.S.]

Such is the title of a charming little pamphlet issued under the auspices of the Imperial Department of Agriculture and written by the Curator of the Botanic Station, Dominica. It is No. 61 of the series, and dated July 13th 1909. There can, in the writer's opinion, be no doubt whatever that there are important possibilities placed in the way of the cacao planter by grafting, since it has been shown that the cacao tree can be propagated with ease by means of the ordinary forms of vegetative reproduction. It was placed on record some years ago in Trinidad that the Cacao tree could be grafted by approach with considerable ease, and specimens were put on exhibition (it is believed for the first time) at one of the meetings of the Agricultural Society of Trinidad, a fact referred to at p. 2 of the pamphlet. Dr Watts draws attention to the point that trees which arise from the grafting process "always develop into a low spreading form," which he considers is an advantage, as the crop can be more easily gathered, and they do not suffer so much from wind. This is to be expected, as it is a well-known feature among plants that when portions of the side branches of a tree are taken, as the *scion* or *graft*, that the tendency of their growth is not so erect as when taken from the leading or upright branches. If the latter were taken for grafts, there would be no complaint of low growth as they would grow as tall as the parent from which they are taken. This is a point long made use of in fruit orchards all over the world.

The method of conducting the operation is carefully laid down by Mr Jones, but the illustrations of the grafted parts are unfortunately on rather too small a scale to inform the uninstructed. Excellent points are made of the prolificness which occurs after grafting and also of the feature of early bearing which has occurred. Mr Jones appears to be of opinion that under shade, the growth would become "drawn or attenuated" in the same way as seedling Cacao. If some of the trees noted in Brown's Table published in *Botanical Bulletin* of Trinidad, April, 1908, were selected and grafted, and fields of a single kind planted there is strong evidence in Mr. Jones' pamphlet that the response would be a field of surprising proportions. The last paragraph of the pamphlet should be carefully followed by all readers; especially should they note the words "*only plants possessing really desirable qualities should be used to supply scions for the grafting of cacao.*"

In connection with this subject, article, No. 336 on Cacao Improvement published in *Trinidad Bulletin*, October, 1906, might be consulted as it gives detailed instructions of the procedure which should be followed in starting Cacao cultivation on the selection and grafting system. The success which has followed Mr Jones's operations in grafting *Theobroma pentagoma* is highly encouraging, his photos of grafted trees clearly prove. The figures of crops of Alligator and Forastero cacao are also instructive, and what will please planters best, his estimate of the cost of production (probably somewhat lower than is possible in Trinidad) will be an encouragement to Trinidad planters "to go and do likewise."—*Proceedings of the Agricultural Society of Trinidad and Tobago*, Sept., 1909.

CHINESE CAMPHOR.

The Hankau market has become in a short time a great export centre for camphor. A Chinese of the name of Liu, resident in Amoy, who knows the camphor industry well, acquired early this year, says the "Chemische Industrie," the monopoly for the production of camphor in the provinces of Hupch and Honan for a period of fifteen years. Hitherto camphor had simply passed through Hankau from the province of Czechuan, and the Chinese population of Hankau is quite ignorant of camphor production. Besides, the transit trade in the article was very small. The figures for last year were 213 pikuls, value 11,408 taels, compared with 1,300 pikuls, value 78,300 taels in 1907. It is now said that Liu has discovered great camphor forests in the province of Honan. He has imported skilled labour from Formosa, and the natives are said to be apt learners.—*Financier*, Oct. 20.

FRUIT-GROWING IN ZANZIBAR.

According to an official report forwarded by Mr Basil S Cave, C.B., H.M. Agent and Consul-General, Zanzibar, possesses facilities for the cultivation of fruit which are not equalled by any country on this side of Africa. Mangoes, oranges, tangerines, limes, bananas, pineapples, figs, and many other tropical species all grow freely, and in some cases profusely, and the country might undoubtedly, if the necessary transport facilities were available, conduct a remunerative trade with Egypt and as far south as Delagoa Bay. If fruit of the right kind could be produced in sufficient quantities it is perhaps possible that the transport difficulties might adjust themselves, and as an experiment in this direction considerable attention is now being devoted to the Kew pine, which, acclimatised in Zanzibar, is one of the finest specimens of its kind in the world. Until, however, the result of this experiment is seen, Mr Cave does not think it would be worth while to invest any large sum of money in the production of a commodity for which no market might be found, or which, if one did present itself, they might be unable to place upon it.—*Field*, Sept. 18.

LIME AND PHOSPHATES IN SOILS.

Experiments that have been conducted for several years in Russia appear to demonstrate that, in soils containing a small amount of lime, the absorbtion of phosphoric acid by the plant takes place to such an extent as to interfere with its growth, because of the presence of an excessive amount of the acid. As the amount of calcium carbonate is increased in the soil by applications of lime, the absorbtion of phosphoric acid decreases, and eventually the stage is reached at which this takes place to so small an extent as to cause the plants growing in such a soil to exhibit all the symptoms of a lack of phosphorous, even in the presence of a good supply of that element.—*West Indian Agricultural News*, October 2.

KOLA.

The quantity and value of kola, which grows most plentifully in the forests of Ashanti and Akim, have steadily increased in the last six years, and the output in 1908 surpassed all previous records. It is exported chiefly by Mohammedans to Southern Nigeria for conveyance to the upper reaches of the Niger. European planters have now commenced to cultivate it, and the Agricultural Department has established plantations at Aburi and Tarkwa. —*British and Colonial Druggist*, Oct. 29.

TEA CULTURE IN RUSSIA.

[Many of the so-called Russian teas with which the trade is familiar are grades of China tea which may or may not have been blended or packed in Russia. The only tea that grows in Russia is that grown on the tea garden of the Imperial Domain estate at Tchakra, near Batoum, and other smaller gardens around it. The tea on this estate is of the Kangra Valley variety, and the seed was brought to Russia from India.]

There are any number of Russian teas on the American market, but perhaps it is not generally known that Russia grows little or no tea, and that most of these so-called Russian teas are really teas grown in China, India and Ceylon, and shipped to Russia for blending and packing.

There is one tea estate in Russia, however, and "The Tea and Coffee Trade Journal" has been fortunate in having taken especially for it some good photographs of this garden. This is the only tea estate of any consequence in Russia, and is known as the tea garden of the Imperial Domain Estate.

A Four-Hundred-Acre Estate.

The garden is located at Tchakra, 13 versts (two-thirds of a mile) from Batoum. The accompanying illustrations show views on this tea estate during the plucking season. There is also a picture showing a view of the tea factory. The tea on the Imperial Domain estate is gathered yearly, and the average annual production is a trifle over 100,000 pounds. The permanent workmen employed on the estate number about 100 but when the plucking season comes on there are some 300 labourers hired for extra work.

The area of the tea gardens is about 400 acres. The manager of the plantation is a Chinaman, who is thoroughly versed in tea culture.

About five years ago Mr Popoff, the well-known tea merchant, started in to cultivate tea around the Imperial Domain at Tchakra, and also in other places nearer to Batoum. A conservative estimate credits Mr Popoff with having spent over 1,000,000 roubles on the enterprise, but owing to the social and economic conditions at present obtaining in Russia, he was forced to suspend. It is thought likely that something further may be done in regard to extending tea culture in this section at a later date.

Tea Culture and Preparation.

The quality of the tea grown on the estates of the Imperial Domains is principally Kangra Valley. The crop is gathered on the Ceylon system, an interval being allowed between each plucking. The bushes are gone over twice at each plucking. The machinery employed in the factory of the Imperial Domains was erected by the Sirocco Works of Belfast.

The Messrs Popoff's estates are situated at three different points near Batoum. The area under cultivation on the three estates is 312 acres, of which about 100 acres have been under tea for about ten years. The crops on these estates are gathered on the Chinese system. The tea produced is stronger than the Chinese tea, none of it boing wasted. There are four qualities, the first is sold at 90 cents, the second at 70 cents per pound, the third at 58 cents per pound, and the fourth (dust) is made into tabloids and sold for the use of soldiers at 12 cents per pound (about 6d per English pound).

Both firms engaged in the cultivation of tea have spared neither money nor pains in their endeavours to render their respective enterprises a success. Tea planting in the Caucasus may at some remote period become sufficiently advantageous to warrant its being generally adopted, but for tho present the industry has not assumed any commercial significance.—*Tea and Coffee Trade Journal*., October.

"PASPALUM DILATATUM" GRASS.

The Peradeniya Curator's letter below is of considerable interest. Certainly Trimen does not make mention of the Australian grass in question; while the "Treasury of Botany" only states that it belongs to tropical and subtropical regions. Is anyone growing it on a large scale in Ceylon?

Peradeniya, Nov. 16th.

Dear Sir,—With reference to the paragraph in your issue of 12th inst. on the above subject, it would be interesting to know how this grass first became known as a native of Ceylon. It was first *introduced* here (from Australia) a few years ago as a valuable fodder grass, being at the time boomed in Australia as "a wonderful grass of Ceylon"! The reason for this may have originated with the intention of gaining an advantage from Ceylon's reputation for valuable products. The grass is really a native of Brazil, so that its introduction into Georgia is not quite such a far cry as Mr. Dallis apparently thought. It thrives to perfection at the higher elevations in Ceylon, and is a valuable acquisition as fodder and for binding railway banks, &c. I see that the name "Dallis grass" has been given it in America, while in Australia it has been christened "The Golden Crown."—Yours faithfully, H. F. MACMILLAN.

PRACTICAL AGRICULTURE AT PUSA.

SHORT COURSES.

Mr. J Mollison, Inspector-General of Agriculture in India, has issued the following note :—

The function of the Pusa College in the general scheme of Agricultural Education in India has been defined as that of a Higher teaching Institution and Research Station for post-graduate agricultural students aud for advanced science students, particulary from Indian Universities. At the present stage of development of the Provincial Agricultural Colleges it also seems necessary for the Pusa Institute and Estate to assist Provinces and Native States by instituting short courses of instruction in special branches of agriculture or in simple industries connected with the agriculture. There are now facilities at Pusa for thorough instruction in the subjects referred to. Such instruction cannot well be given in other parts of India for at least some years ; therefore I hope that a hearty response will be given to the proposals which I note below. The short courses which I propose are broadly defined in a Syllabus for each subject which is appended hereto. I attach the greatest importance to the value of these courses. There is an undoubted demand for them, but it is impossible to get at present elsewhere in India such simple technical instruction except as a part of much longer course. The instruction will be essentially practical in character and will require no scientific training and not even a knowledge of English. It would, however, bo an advantage if the men had all a fair general education. Men who have not the instincts of the professions which they are following or propose to follow will not be accepted. I desire to admit in particular to Pusa for these courses men, who are *bona fide* agriculturists or *malis* by caste. The courses will be suitable for men of the subordinate staff of all the Agricultural Departments, and will be open to private individuals who are engaged or propose to engage in the special branches of agriculture and allied subjects dealt with. It is not possible at first to take more than nine students in each subject at one time, but several subjects can be simultanoously taken up by the same students. A recommendation by a Director of Agriculture or any other authorised authority will be accepted in regard to any application for admission, if the applicant is certified to be of good character and in robust health. Free quarters of a very simple but sufficient character will be provided. Students will have to pay all travelling and personal expenses. The latter at Pusa need not exceed R15 per mensem and might easily be less. No books will be required. It is proposed to start classes as soon as possible ; so applications should be addressed to the Director and Principal, Agricultural Research Institute, Pusa, Bengal, at as early a date as possible.

SECTION OF AGRICULTURE.

CATTLE BREEDING AND MANAGEMENT.—The course will occupy three months. It will deal with the general management of breeding herds and of milch and draught cattle and will include simple instruction in the recognition, treatment and prevention of the more common diseases. The second Imperial Entomologist will deal with the principal insect-pests of cattle, the part which they play as disease carriers and methods of treatment. Courses will commence in October and January.

POULTRY MANAGEMENT.—This will be a three months' course and will include instruction from the second Imperial Entomologist in the treatment of the insect-pests of poultry. Courses will commence in Oct. and January.

DAIRYING.—This is intended to be a complete course extending over six months, in up-to-date dairying.

TILLAGE IMPLEMENTS AND AGRICULTURAL MACHINERY. —Training will be given in the principles of construction and in the handling of the common Indian and European tillage implements and agricultural machinery, including ploughs, drills. cultivators, water-lifts, steam-engine, oil-engine, etc. Arrangements have been made for a complete collection at Pusa of all useful indigenous agricultural machinery, implements and tools. The course will occupy three months and will commence in October or January.

SECTION OF ECONOMIC BOTANY.

FRUIT GROWING.—The course will be an eight month's one and will deal with—

(*a*) The general management of a fruit garden including choice of site, laying out, draining and planting, the choice of varieties, irrigation, cultivation and manuring. (*b*) Special processes, such as budding, grafting, layering, pruning and root pruning, weathering. (*c*) Disposal of fruit, including picking, grading, packing and marketing. (*d*) Evaporating, drying and preserving.

The course will begin each year on the 1st of October and will last till the end of May.

SECTION OF ENTOMOLOGY.

ERI-SILK AS A COTTAGE INDUSTRY.—The course will occupy about three months and will commence in October and January. It includes rearing and spinning. If dyeing and weaving are to be learnt, three months more would be required.

LAC CULTIVATION AS AN ADJUNCT TO ORDINARY AGRICULTURE.—The training can be given only from the 15th May to the 15th June or the 20th September to the 20th October. These dates vary a little according to the season as lac does not always come out regularly. The training includes pruning and handling of trees, inoculation of lac, harvesting scraping and washing. It covers the whole industry to the production of seed lac and is exclusive of the production of shellac.

MULBERRY SILK CULTURE.—The course would include rearing, selection of disease-free eggs, reeling and the utilisation of waste cocoons. Instruction would also be given in the varieties of silk worm. Silk twisting (spinning) and dyeing with the simpler forms of weaving could be taught. The course would occupy six months if it ended at the reeling, nine months if it included twisting, dyeing and weaving of simpler fabrics. The training would cover only the ordinary existing methods, not improved methods or reeling of the more complex forms of weaving. The course will commence on the 15th June each year.—*M. Mail*, Nov. 15.

LECTURE ON AN ARECA PALM DISEASE.

BY THE MYSORE MYCOLOGIST.

Mysore, Oct. 31.—After some postponements the lecture promised by Dr. Leslie Coleman was delivered at the Lecture Hall in the Exhibition grounds at 8-30 a.m., yesterday. The Dewan of Mysore, Mr. T Ananda Rao, said a few words by way of introduction, though, as he said, it was really unnecessary to introduce the State Mycologist, who was well-known to most, if not all, of those assembled in the Hall.

Dr. Coleman spoke to the following effect, exhibiting specimens here and there, and making a few sketches to show the forms of some of the spores, etc., of the fungus which was the cause of the plant disease he had selected as his subject, viz., *koleroga*, a disease that affects the *supari* or areca, more especially in the Malnad tracts of the State of Mysore:—

Koleroga of *supari* is a disease produced by a definite parasite. The *koleroga* fungus is an organism much simpler and more insignificant in appearance ; it never forms any such body as the shelf fungus or mushrooms we so well know. It is because of this smallness of size and of the fact that its real structure can be made out only under the microscope that it so readily escapes attention ; in fact, it is known largely only by the effects it produces and these effects are certainly serious enough,

THE FIRST APPEARANCE.

Shortly after tbe monsoon breaks, usually anywhere from the beginning to the middle of July, we hear that *koleroga* has broken out in the Malnad parts of Shimoga and Kadur Districts. If we visit one of these gardens we find that the nuts are beginning to drop dowu from the bunches. If we look at one of these fallen nuts we shall almost certainly find that it has more or less fully lost its beautiful clear green colour and that a certain part of the surface is covered by a whitish or grayish growth somewhat like cotton wool whicb has been soaked in water. This is tbe white *koleroga*. (Of the black or water *koleroga*, wbich is a quite distinct thing, and which causes comparatively little loss, I shall say nothing today.) If we scrape off some of the surface material and examine it under the microscope, we shall find here again a mass of interwoven threads. But we must not think that this is all of tbe fungus. Before tbis material has appeared on the surface at all, the fungus has been growiug inside the nut and nut shell, spreading out among its tissues and taking up from it its nutriment and even its living substance. But how did it get inside? In order to uuderstand this we must study the life-history of the fungus more carefully. As in the case of higher plants, so in the case of the fungi, the life of the individual may be divided, not very scientifically it is true, iuto various stages. These are the stages of germination or sprouting, the stage of growth and the stage of fruit or seed building. These, of course, cannot be separated by a sharp liue. For instance, growth continues very commonly after seed formation has begun, and in the case of trees it, of course, continues for many years.

[Its life history, and known remedies, are described and Dr. Coleman proceeds :]

REMEDIES.

In the light of all these facts I thought it wise to attempt the solution of the difficulty in anotber direction. The method consists in spraying on to the nuts as a fine mist a solution of a substance which as long as it remains on the surface of the nuts absolutely prevents the growth of any of the spores of tbis fungus, that may fall on it. This material, commonly known, as "Bordeaux mixture," from the part of France where it was first used, is now used all over the worlds as a means of combating fungus diseases. It consists of a mixture of blue vitriol (copper sulphate) and unslaked lime in water prepared in definite proportions and in a definite way. To this I have added a solution of resin and soda with a view to make the mixture stick well to the nuts through the heavy rains of the monsoon. The experiments this year were ratber upset by the very late arrival of sprayers from Europe and the very early break of tbe Monsoon. Tbe result is tbat most of the work was done under about the most unfavourable circumstances possible. My purpose was to have practically all my spraying done before the Monsoon broke, but this I was unable to do for the two reasons mentioned above.

Altogether over a thousand trees were treated, and, considering the adverse circumstances, witb very gratifying results. It is, of course, essential for the success of such an operation that the material used should not be washed off by the rains. In order tbat this may be managed, it sbould first be able to dry on to the nuts. This, I may say, was by no means possible in all cases with our experiments. In every garden but one (that at Seetoor) some rain fell during tbe operations or so soon afterwards that I had my serious doubts whether most of the solution would not be wasbed off. The results are, as I say, not yet all known, but as far as I myself have seen and as far as has been reported by my staff, with a single exception, where the spraying had clearly been most carelessly and badly done, where nuts have become diseased on sprayed bunches only a very few have been affected, so few in fact as to be practically negligible and be readily accounted for by tbe material having been washed off before it was dry or by the spray baving not been evenly put on.....

In conclusion, let me emphasize a few points in connection with the whole subject. Tbe removal and burning of all old diseased parts, bunches, nuts, tree tops is the very first step in the combating of this disease. The system of tying covers is more or less efficient but can bardly allow of itself being carried out so tborougbly, nor is it so efficient, as to give the very best results possible. The system of spraying the Bordeaux mixture, altbough but in its experimental stage, seems almost certain to be the best method of controlling the disease. It has one great advantage over *kotte*-tying not mentioned above, *viz.*, that even where a bunch has already some nuts attacked, tbe disease can be checked, whereas *kottes* would favour rather tban hinder the growth of the fungus under such circumstances. In addition, it gives the nuts their normal amount of light and air, wbicb the *kottes* do not allow of. Its application in no way injures the nuts as far as our experience goes. Any combative measure to meet with the best success must be undertaken before the disease has appeared; it must he in the nature of insurance against attack. This appears especially to be so in the case of *kotte*-tying and in every case is a thing which I wish to emphasize most strongly.—*M. Mail*, Nov. 2.

TRAVANCORE AGRICULTURAL DEPARTMENT.

A YEAR'S WORK.

The report on the working of the Agricultural Department for the past Malabar year, ending with the 16th August, 1909, submitted to Government by Dr. N. Kunjan Pillay, the Director of Agriculture, is an interesting document. The Department, as reorganised during the year, consists at present of a Director of Agriculture, one Senior Agricultural Inspector, two Agricultural Inspectors—all Diplomaed Agriculturists of the Agricultural College at Saidapet—two Agricultural Sub-Inspectors—local and Madras trained men—and a Laboratory Assistant.

The work in the Government Farms was changed from demonstration to experiment. The Director says that the value of demonstration in stimulating interest among the ryots in improved methods of agriculture is not underrated, and that before an improved method is recommended to the ryots, its suitability to local conditions must be tested ; and hence in the natural course of things, demonstration ought to succeed experiment. There is an Experimental Farm at Kottarakara (Central Travancore) and the Farm at Quilon is retained purely for purposes of demonstration. There is also a Cattle Farm opened at Trevandrum and an Agricultural Laboratory. The Demonstration Farm here has been changed into an Experimental Farm. Its total area is 33½ acres, of which only about 25 acres are available for cultivation. The soil is a sandy loam, consisting chefly of alluvial deposit brought down from the adjacent compounds and paddy fields and by the floods in the Karamanai river close by. Being very near the river, the farm is subject to inundations.

The Coconut Palm Disease.

Next in importance to paddy is the coconut. In view of the prevailing disease attacking the coconut palm, a Special Officer, in the person of Mr. B. S. Narayanaswamy Iyer, has been making enquiries into the pest. The necessary experiments are being conducted at fixed centres in Central Travancore by the Special Officers, and it is premature to form any definite conclusions, as the earliest experiment is only nine months old. It is, however, satisfactory to note that the letting value of the compounds taken up for experiments has increased since the starting of the experiments—a testimony to the practical nature of the remedial measures adopted by the Special Officer. It will be remembered that one of the suggestions made by Dr. E J Butler, the Imperial Mycologist, who investigated the disease here, was to destroy all attacked trees. In the opinion of Dr. N Kunjan Pillai, "the destruction of attacked trees is impossible in

the face of the objections that may be raised by the ryots, and it is impracticable on account of the heavy expenditure it would entail. It cannot, therefore, be undertaken on a large scale, as has been done in the case of the palmyra palm disease in the Godavery District." The coconut palm manures now distributed are caster-cake, coconut-mixture, etc., and it is not intended to recommend any costly experiments to the ryots before the Agricultural Officers are in a position to form definite conclusions as results of the experimental measures now being adoptod. Mycological investigations of the disease will be taken up when the sanctioned Laboratory is fitted up.

CROPS AND FERTILISERS.

Under this head, there is an exhaustive account of the work done in connection with the cultivation of paddy, the most important crop in the State. Experiments with different kinds of manures were conducted at Parvathipuram, South Travancore, Trevandrum and Quilon and Kayankulam in Central Travancore. The experiments were conducted in lands belonging to ryots, and the arrangement was that the ryots should do all the cultivation, the manures alone being supplied by the Department, the ryots getting the whole produce; the object in such an arrangement was to create an interest among the ryots and also to advertise the results of the experiments. Tho application of nitre has given the best result, the yield being 23½ fold on the quantity of seeds sown. The next best yield was from the application of superphosphate and nitre. Cattle-manure comes next in rank, while ashes and Parry and Co.'s paddy fertiliser give equal yield, the last being considered as not better than country ashes. The financial aspect of the matter may be noted. In the case of nitre the gain per acre was about R27, and in the case of cattle manure the gain was R13 nearly, straw not being calculated in the two cases. It is, however, to be noted that the experiment made was on a small area of 33 cents. The figures given above as general conclusions have, therefore, to be taken with caution. The results of the experiments carried on at Trevandrum are more or less similar to those conducted in South Travancore and summarised above. The results of the experiments carried on under different methods of sowing show that dibbling gives a better yield than broad casting, but it is more costly. Here also the same remark has to be made in regard to the general conclusions drawn, viz., that the plot under experimental cultivation was 10 cents. With a view to study the characteristics of different varieties, in order ultimately to select the best that are suited to different conditions, more than 150 local varieties of paddy were collected, sown in nursory and were afterwards transplanted singly in small plots. The seedlings are all reported to be coming up well. Small quantities of *Banku*, *Badshabog*, *Ambamore* and a Poona variety were got from outside the State and cultivated in the Trevandrum Farm. The crops have not been harvested. But they are reported to have grown well. It is proposed to collect the seeds from these varieties and distributo them among the ryots. An interesting variety called *Taung-daik-pan*, which is said to have great capacity to resist drought, has been proccured from Burma and has been sown in the nursery.

TAPIOCA, SUGAR AND GROUND-NUTS.

Another staple crop is tapioca. During the past year applications for tapioca stalks were received from the Director of Agriculture, Punjab, and from Mr. Gustav Haller, Coorg. At the request of the former, an Agricultural subordinate was sent to Lahore to demonstrate cultivation of tapioca. He was there nine days, and gave satisfaction to Mr Milne, Economic Botanist.

The manufacture of sugar is beginning to engage the attention of the people and several enquiries were made and a young Travancorean has had his training at the Sugar School at Bareilly, United Provinces. During the year four varieties—Red and white Mauritius, one Bombay, and one local variety—were planted, the object being to study the characteristics of these varieties, with a view to select the best of them for distribution among the ryots.

Of the exotic crops, ground-nut, which was introduced when the Trevandrum Demonstration Farm was opened in 1895 by Mr B S Narayanaswamy Iyer, has become acclimatised to the soil, and is being slowly introduced into the mofussil too, where the ryots are taking to the crop and have begun to cultivate it. Other exotics, which are being successfully grown, are sunn-hemp, jute and maize.—*M. Mail*, Nov. 18.

EXPERIMENTS WITH CAMPHOR IN JAMAICA.

An account of experiments with camphor, which were carried out at the Government Laboratory, Jamaica, is given in the Report of the Department of Agriculture for that island for the year 1908. Weighed quantities of different parts of the stem, which were obtained from trees growing at Knockalva Pen, were subjected to steam distillation, and the distillate suitably treated in order to separate oil and camphor, the latter then being heated over quicklime for the purpose of getting the pure sublimate. The highest yield of camphor was obtained from the tips of the shoots. The amounts of camphor-oil and camphor that were obtained on an average, from the whole stem wore respectively 0·23 per cent and 0·28 per cent, making a total of 0·51 per cent. The *West Indian Bulletin*, Vol. IX, pp. 275-6, gives an account of somewhat similar experiments that have been carried out at the Government Laboratory and Botanic Station in Antigua. In these, oil only was obtained, and it was found that the wood gave 0·4 per cent of this, while the amount that was obtained from the leaves and twigs was 1·2 per cent. Thus in both cases the observation was made that the younger parts of the plant give the largest yields.—*W.I. Agricultural News*, Oct. 16.

BANANAS GROWN IN KENT.

A hothouse at Tunbridge Wells contains two large banana bushes, each heavily laden with ripe, excellently flavoured fruit. Each bunch contains about 200 bananas. A constant temperature of 100 dogrees has to be maintained.—*Lloyd's News*, October 10.

THE RUBBER INDUSTRY.

(*To the Editor, "Aberdeen Free Press."*)

Sir,—The Brazilian Legation in London are credited (in your leading article today) with predicting the downfall of the rubber industry in the East, as it is now grown under natural conditions—*i.e.*, unweeded and in jungle? Actual experience has proved this to be the reverse of the truth, and it may interest your readers to know that, though over 30 years old, trees on Ardoden estate, (? Culloden) Ceylon, recently gave crops of 18 lb. per tree, the last four years in succession, and look like continuing to give good crops for many years to come. If any of your readers want to invest in rubber shares they will be wise to invest in the shares of those estates which have been properly weeded and kept free from jungle growth from the first. I speak from bitter experience.—I am, etc.,

L. DAVIDSON.

York House, Cullen, Oct. 28th, 1909.

RUBBER PROSPECTS IN PAPUA.

Much interest is being aroused in Papua (formerly British New Guinea) by the promise of the new rubber plantations. None of these are in full bearing, but the progress of the trees has been so remarkable that the Haevia Brasiliensis is expected to be ready for tapping a full year sooner than in Ceylon or the Malay States. It has also been found that various kinds of rubber-bearing plants which in other countries produce "latex" of small tensile strength and low value in Papua will yield a good marketable rubber. The best known of the wild rubber trees of Papua, the "Ficus Rigo," is now being largely cultivated. There are a number of wild rubber vines, from which the natives procure rubber said by experts to be actually superior to the best Para. Everything, in short, seems to point to a remarkable future for Papua as a rubber-producing country.—London *Times*, Nov. 3.

CEARA RUBBER TAPPING.

(TO THE EDITOR, "INDIA RUBBER JOURNAL.")

Sir,—We have now been growing Ceara rubber for three years, and have trees ready to tap, but we find everywhere a lack of information as to the best methods of tapping and comparative yields of these trees. The method of tapping hitherto observed has been that of picking the bark with horizontal stabs of a broad-pointed knife after rubbing the stem with dilute acid.

By this means the rubber which exudes in drops and coagulates on the stem is collected in balls, but it is obvious that the cleanest way of collecting it, especially from a number of small plantations, is to collect it in the liquid form and treat it in a central preparing house, so as to obtain a regular and clean sample of sheet or block rubber.

Now I believe that in German East Africa where they have been experimenting and collecting information for years, they have recently evolved new and better systems. They are, in fact, far in advance of our own colonies as regards the Ceara rubber.

What I particularly want to find out is :—

(a) The best method of tapping Ceara, in order to collect the latex in liquid form, and the best knife for the purpose.

(b) What machinery, if any, and treatment is best for this kind of rubber.

(c) What may be taken as an average yield over large plantations as those in G E Africa, in which up-to-date methods have been observed.

If you can help me in any of these, you will receive the gratitude of many new planters in British East Africa.—I am, Sir, yours faithfully,

CEARA.

[We have replied to this correspondent direct, but any aid which readers may proffer will be acceptable.—ED., *I.R.J.*]—*India Rubber Journal*, November 1st.

LONDON FORWARD SALES OF RUBBER.

(*To the Editor, "India Rubber Journal."*)

SIR,—The present high price of rubber has occasioned a good deal of comment recently, and doubts are expressed in some quarters as to the prospects of its continuance. We may say that we have recently arranged a number of contracts for estate crepe and sheet for 1910, and are still open for similar business. For instance, 25,000 to 30,000 lb. to be delivered in about equal quantities monthly, or possibly bi-monthly, at following rates :—

No. I. Crepe or sheet at about 7s. 6d. to 7s. 8d., according to quality.

No. II. Brown crepe (scrap) at about 6s. 9d. to 6s. 11d., according to quality.

Any quantity which owners would sell we could, no doubt, get through.—Yours, etc.,

BROKER.

20th October, 1909.

[The above letter emanates from a well known Mincing Lane house, and indicates that there is an important section of the trade which looks for the continuance of high levels throughout 1910. We have heard privately of a number of such bargains, and a further number have been announced publicly. For obvious reasons we do not publish the name of our correspondent.—ED. *I. R. J.*]—*India-Rubber Journal*, Nov. 1.

RUBBER DISCOVERIES IN MEXICO.

Mexico has long been known as the home of the castilloa elastica, from which some 5,000 tons of rubber are annually extracted. Many capitalists, including the Standard Oil Company, are now engaged in exploiting a shrub called guayule, and the output from this source alone is considerable.

Some years ago the Mexican Government engaged Professor Pehr Olsson Seffer, an eminent botanist, to examine for them the flora of Mexico, with a view to the discovery of new economic plants. He has been engaged in this work for the past five years. The net result of his researches has been the discovery of many entirely unknown trees and shrubs which bear latex containing rubber. They are not all equally valuable, but of many it may be said that they offer a better reward to the capitalist

than the guayule. Mexico is the home of the euphorbia, and one variety, known locally as palo amarillo, occurs in large quantities. It yields a rubber of inferior quality, is difficult to tap, and only produces about an ounce of rubber from each tree per annum. Dr Seffer has paid great attention to the varieties of plumeria. These plumerias occur over considerable areas in many parts of Central and Southern Mexico. The latex is white and creamy, and flows plentifully in November, December, and January. The amount of rubber in the latex varies, but runs as high as 24 per cent., and as much as 1lb. 3 oz. of rubber has been obtained from a single tree by the ordinary method of tapping.

Another rubber-bearing plant, a euphorbia, called locally Vara Leche, contains latex of a rubbery nature; but it is doubtful whether it is of any commercial value. The shrub known as chupire, a species of euphorbia, also produces a very white latex, which flows freely and contains about 21 per cent. of rubber. Another rubber plant found on the hillsides of Mexico, called the játropha urens, has the local name of Mala Mujer. As its name (the "bad woman") suggests, it is a particularly disagreeable shrub. The young branches are, however, full of latex, and chemists who have analysed the product are of opinion that it is a pseudo rubber, having many points of resemblance with rubber and gutta or balata. The shrub is found in great quantities over large portions of Southern Mexico. It is so common that it is possible it may one day assume some commercial importance.

Dr. Olsson Seffer also discovered a new játropha of the curcas group, which gives a latex containing a good grade of rubber. Two more species, one called "cordoban" and the other a plumeria, were also found to be rubber-bearing, but they are probably of small commercial value. The researches made by Dr. Seffer are interesting, as they show that we are in no danger of exhausting our rubber supplies, but that, on the contrary, each year brings forth some new cource of supply.—*H. & C. Mail*, Nov. 5.

NEW ROOT RUBBER.

We publish in our daily and *T. A.* particulars from the *Kew Bulletin* of Ecanda rubber, a comparatively new source of production of raw rubber found in Angola at an elevation of 5,000 feet. A concession has already been given for the whole plateau where it grows, and we do not expect that it is to be found in many parts of Africa. Nor do we anticipate that its cultivation will be taken up in other parts of the tropical world, more especially as the seed is so hard to get, the cost of collection amounting in fact to £4 sterling per ounce. There is a certain amount of care shown by the natives and conservation of what was grown, only the large tubers weighing from four to five pounds being retained to get the rubber from, and the smaller ones being replanted. The particulars are of interest, though, as we have said, we do not expect any practical extension of the cultivation to take place.

"MANIHOT DICHOTOMA" RUBBER.

We see that enquiry has been made as to why Manihot Dichotoma seeds, though quite fresh, fail to germinate. One lot got out from London gave only 3 per cent., and another lot obtained locally—though tested and found to be quite fresh before planting—gave no more than 10 per cent. The Yatiyantota planter who received them dug out some from the beds of the second lot (laid down three weeks ago) and on examination found most to be fresh, but noticed a sort of white fungus developed round the radical end of the seed. He asks a contemporary if this has anything to do with the bad results obtained. We learn on enquiry, on good authority, that the conditions for germination may be at fault. It would be advisable to have all the seeds, which show no sign of germinating, removed from the soil, and soaked in hot (almost boiling) water for a few hours. They should then be sown in light sandy soil that is free from manure and rotting mould, this being kept moist and shaded. *Manihot dichotoma* seeds become hardened with age, when, like those of Ceara-rubber, they should be filed at one or both ends before being sown. Otherwise their germination may be considerably retarded. When these seeds are fresh, and their vitality is unimpaired, they should germinate within three weeks from date of sowing.

BANANA RUBBER.

(To the Editor, *India Rubber Journal.*)

Sir,—With regard to the remarks on banana rubber which appeared in your journal of the 6th September, it is necessary to point out that it is an admixable rubber, and that when compounded with another rubber adds to the weight of that rubber, without deteriorating. This appears from our many experiments to be the effect and as this fact when known may benefit the farmers of the West Indies as well as other localities, it is certainly worth publicity in your journal. The quantity of rubber from each banana tree, after the bunch of bananas is gathered, is generally highly satisfactory.—I am, Sir, yours respectfully,

George C. Benson.

51, Main St., Georgetown, Demerara, W.I.
—*India Rubber Journal*, Nov. 1.

RUBBER TAPPING.

A New Industry Created.

Now that so many estates are either in bearing or coming into bearing, the demand for tapping cups is increasing very rapidly, and new varieties are being put on the market. Earthenware cups have for some time been coming into favour, and now there is a considerable demand for glass and porcelain vessels. The earthenware cups have hitherto been mostly of local make, but are now being exported in considerable numbers from England, where they are manufactured with a finer finish than in Malaya The porcelain cups come from England and Austria, while those made of glass are manu-

factured in England and Belgium. The terne plate cups, often erroneously called "tin" cups, which are, of course, still very largely used, are exported from England. Large as the demand now is, it is not difficult to foresee that it is nothing to what it will soon become; while even in five or six years' time, when the present vast planted areas are in bearing and supplied, the opening up of new land and the need of replacing existing stock will guarantee a steady market for tapping cups as long as rubber remains a profit-earning product. In these circumstances it is interesting to notice that the Home manufacturers appear to be awake to the possibilities which this trade holds out, and are pushing their goods in an enterprising manner.—*Malay Mail*, Nov. 16.

BOMBAY MANURE FOR CEYON ESTATES.

A NEW DEVELOPMENT.

We received at the beginning of this month a letter from the Executive Engineer of the Bombay Municipality, asking if there would be any demand for artificial manure manufactured out of the refuse of animals destroyed under Municipal supervision there. Particulars were given of the contents of such a product and a rough estimate of the cost; it was also stated that there was practically no smell. Information was asked for as to the demand for such manure for estates in Ceylon; and, with a view to obtaining the information required, we approached the Colombo firms interested and forwarded their replies, as well as other expert opinion, to the Bombay official who wrote to us. In the course of these enquiries we learnt that no doubt was felt here that such refuse had a considerable manurial value; there was no reason to suppose that it would not make a satisfactory ingredient for tea and sugar-cane manure from this point of view alone. To command a sale in Ceylon, it would have to compete successfully with fish manure, at present a cheap source of Organic Nitrogen and Phosphoric Acid. There is no dividence to show that meat meals possess any advantage over fish refuse, and many other forms of waste organic matter, as regards the availability of their manurial constituents; and they fall considerably short of the true Guanos in this respect. Any caleulation of the value of meat meal for sale in Ceylon, therefore, must be based on the value of fish manure here, and on that basis a material with the analysis quoted from Bombay would be valued by Ceylon manure merchants at about R70 per ton, making allowance for the fact that it would probably be more finely ground and more free from fatty matter than the fish received here usually is. Our correspondent stated that the material will be free from offensive smell. This is an important point, but experience with European and American meat meals created doubt as to the possibility of this—the smell from these being such as practically to prohibit their use. The point emphasized by the experts consulted was the necessity for freedom from offensive smell. One opinion stated that it must not only be free from offensive smell, but olso from any large proportion of fat; also in a fine mechanical state so as to be easily used. Another point was that the flesh must not become decomposed before the manure was prepared or exception would be taken to it for use on fields above any water supply. The composition as described to us is judged to be good, and at the relative price of best fish manure enabling mixtures to be cheapened somewhat, but the composition would have to be uniform and the supply constant. One of the questions asked us here was would such a manure be available in regular quantities?—great inconvenience arising when a demand was created for a material and the supply of it cannot be depended upon. It must, we were told, be also at least as cheap as fish manure per units of nitrogen and phosphoric acid; the amount of potash mentioned was too small to be of consequence in tea manuring.

Today we have had an acknowledgment of our letters and enclosures, and the Executive Engineer of Bombay refers to the fact that the supply of the manure in question would be constant and, being of the quality indicated, he thought it would be of some service in this island. The supply expected will be equal in bulk to 10 bullocks and 30 goats or sheep per day. As regards smell, the Bombay official examined some of the composition when in England in June last. He found nothing offensive in it and could handle it freely without discovering objectionable properties. Its mechanical condition was such that it flowed through his hands like coarse oatmeal.

We learn, finally, that the Bombay Municipality have decided to adopt his proposals during the next financial year, and fuller particulars will be forwarded as soon as available. All that remains to be done is to submit samples of their manure to the Ceylcn Government to be passed by the Port Medical authorities, any such product coming from a plague centre like Bombay being open to suspicion until the Plague Committee here are fully satisfied as to the conditions under which it is produced and the strictness with which such regulations are maintained.

TAXI-CABS AND THE DEMAND FOR RUBBER.

As regards the users of rubber, reports have been received indicating an enormously increased demand for tyres, and huge contracts are reported to have been placed by a syndicate interested in the taxi-cab business. Great extensions of the taxi-cab industry are anticipated and with these extensions a great increase in the consumption of raw rubber for tyre manufacture. A number of manufacturers who have fixed up contracts for manufactured goods have apparently covered themselves by buying forward supplies. On the other hand, contracts usually given out at this time have been postponed, and the trade in this country must be suffering severely from the consumer's very natural dislike to buying at prices so much above the usual level. Investors in rubber growing companies have persuaded themselves that it will be some time before the supply of rubber overtakes the demand.—*H. & C. Mail*, Nov. 12.

LICENSES TO SELL RUBBER.

In the first number of the *F.M.S. Government Gazette* is published the draft of 'An Enactment to provide for the Control of Dealings in Cultivated Rubber,' which will be submitted to the first meeting of the new Federal Council. After stating that the words 'cultivated rubber' include any product from a plant or tree on alienated land yielding rubber or gutta percha, and that the Licensing Officer is the District Officer, or such person as the Resident may have appointed to take his place, the draft Enactment goes on to say that, unless duly licensed, no one shall purchase any cultivated rubber; nor shall anyone keep any factory for the purpose of treating rubber, or keep a house for storing rubber not grown on land in his occupation. It is laid down that a license to purchase rubber will include the right to keep a place for its purchase and storage, while a license to treat rubber will include the rights conveyed by a license to purchase. The cost of a license will be $25, but no license will be issued till the applicant has made a deposit of $200. The deposit will be returned at the expiration of one month from the date on which the license expires or is ortherwise determined, but no return will be made while legal proceedings under the Enactment are pending against the licensee, and the moneys deposited shall be liable to be applied in satisfaction or part satisfaction of fines inflicted under the Enactment. The interest on a deposit shall be payable to the depositor. The licensos will expire on Dec. 31st on the year of issue and are not transferable.

Powers of the Licensing Officer.

The Licensing Officer will have power to refuse to grant or refuse to renew a license, but if required by the applicant or licensee, he must state, in writing, his reasons for his refusal. He may also, with the approval of the Resident-General, refuse a license to any person "who is the agent of or is under any obligation or agreement to act for any individual, corporation or combination which he is satisfied is attempting, or about to attempt, to secure control of the output of, or the market for, any cultivated rubber."

The Licensing Officer will also be empowered to cancel a license, if the licensee applies for the return of his deposit or upon the licensee's conviction for any offence under the Enactment or on any charge involving fradulent dealing.

It is also laid down that the Licensing officer shall, upon the receipt of an order from the Resident General, cancel the license of any licensee who in the opinion of the Resident-General is acting with a view to control the output or the market of rubber, either on his own behalf, or on behalf of some other person or corporation. Such a cancellation, however, will be subject to the approval of the High Commissioner.

Duties of the Licensee.

The draft Enactment provides that the licensee must always keep his license posted in a conspicuous place, and he must at all times allow his premises to be inspected by the proper authorities. He will also be required not to purchase rubber except on the place where his license is posted. Further he must keep books and enter in them, from day to day, particulars concerning his dealings in cultivated rubber. These particulars comprise: the date of the transaction, the namo and address of the person dealt with, the weight and description of the rubber, the price for which it was bought or sold, and tho number and description of the title of the land on which it was grown. The books must be produced when required, and must be preserved for a year following the date of last entry.

A licensee may purchase, and a forwarding agent may receive, no rubber except upon the delivery to him of a written authority from the vendor or consignor for the sale or despatch of the rubber, and this authority must bear the signature or "chop" of the person in occupation of the land on which the rubber was grown, or of his agent.

Penalties.

Any person committing an offence against, or failing to comply with, the provisions of the Enactment will be liable on conviction to a fine not exceeding $1,000. A further provision lays down that the Resident may, with the approval of the Rosident-General, make rulos under the Enactment, and anyone infringing these rules will be liablo to a fine of not more than $500, and, if he continues to commit a breach of the rules, ho will be liable to a fine of $50 a day as long as the breach continuos. A Magistrate's Court of the first class will have power to try all offences under the Enactment, and the Court may direct that a sum of money, not exceeding the fine levied; be paid to anyone upon whose information a conviction is obtained. Appeals from the decision of the Magistrate's Court must be made to the Resident within 30 days, and the decision of the Resident will be final. When the refusal or cancellation of a license has been made by the District Officer upon instructions from, or under the advice of the Resident, the rule regarding appeals will not apply. The rules under which an action can be brought to recover damages for anything done by Government offices under the Enactment are the same as those usual in such cases.—*Malay Mail*, Nov. 23.

(*To the Editor, "Malay Mail."*)

Sir,—In connection with your review of the draft Enactment "to provide for the control of dealings in cultivated rubber," there is one point which I think should be cleared up in the interests of the numerous Malay holders of small plots of land which in the aggregate already produce a considerable amount of rubber.

Clause 3 renders it unlawful for any person unless duly licensed in that behalf:—

i. To purchase any cultivated rubber. ii. To keep any factory or placo for the purpose of treating cultivated rubber. iii. To keep any house, store, shop, or place for the purpose of purchasing or storing therein any cultivated rubber other than such as has been grown or produced on land in his own occupation.

This last sub-section safeguards the right of the occupier to keep a house, store, etc., for the purpose of storing therein any rubber grown on his own land without the necessity of obtaining a licenso. It does not soem to have occurred to the learned framers of the Enactment that a similar exception should be added to sub-section 2, or olse tho owner of an acre of land with (say) twenty tappable trees thereon, who 'treats' his latex himself will have to take out a license, for he will be 'keeping a place for the purpose of treating cultivated rubber.'

The casual reader may remark 'Well why shouldn't he?' But the answer to this is to be found in section 4 which requires payment of a fee of $25 for a license, which 'shall not be issued until the applicant therefor shall have made a deposit of $200.' So that before the small holder can treat his own latex, as many of them do, he has got to deposit $200 and pay $25. After this one is really surprised to read that 'interest allowed by the Bank' (what bank?) 'on the amount referred to shall be payable to the depositor' and that the deposit itself will actually be returned 'after the expiration of one month from the date on which it expired.'

It may be necessary, it no doubt is necessary, to pass an enactment to control the dealers in cultivated rubber, but it is, I submit, an unheard of thing that many small Malay cultivators should be prevented from treating their own rubber and be compelled, as they must be by this Enactment, to sell or lease their trees to those who have sufficient capital to put down $225. We hear a great deal from time to time of Gubernatorial and Governmental anxiety to benefit the Malays, but I can hardly think that the learned framers of this extraordinary law can have reflected on the fact that if it passes unamended probably nine out of ten of the Malay smallholders cultivating rubber will be deprived of a large part of their legitimate profits which will in future go to swell the profits of the Chinese and European capitalist.

Yours, etc.,

DAVID FREEMAN.

--Ibid, Nov. 24.

RUBBER IN B. N. BORNEO.

Tambunan District.—Experiments are being made with rubber stumps and seeds, 100 stumps and almost 1,000 seeds having been planted. At the time of writing no seeds had come up.

Kudat.—Tho manager of the Pitas, Ranau and Bandau estates is shipping by this boat a small sample of Para rubber, about 100 lb., from the 400 trees he is tapping. Round the manager's house had been planted several trees of the Ficus Elastica. Mr Metelerkamp as an experiment tried mixing a small portion of the latex of these trees with the same quantity of Para rubber latex. The two or three sheets I saw appear to be of a blood red colour when drying, but do not appear to be as flexible as the true para. I am informed that samples of this rubber unmixed with para will also shortly be sent home for report.—W H Hastings, Resident.

Beaufort.—I found on my return that an estate cooly under sentence had escaped and, making his way to Padas Valley estate, had been badly speared by a string trap set by the Manager's orders to kill deer and pig. I found that large numbers of these traps had been set and accordingly fined the manager $75. He was lucky in escaping a far more serious charge as the man had a narrow escape from being killed.—P C Brackenbury, District Officer.

Kaningau.—I received 210 rubber seeds from Tenom on this day and these are now coming up well. On the 15th 100 stumps arrived for me, 100 being sent on to Tambunan the same day. These I planted out at once. On the 16th, 17th and 18th I was out on the bridlepath for the greater part of each day supervising the bridges. The Muruts are slow at this kind of work and need a lot of help. On Sunday the 19th I received a further consignment of 290 rubber seeds, this makes a total of 500 that have been supplied by the Resident. Up to the time of writing 200 have already come up and there are signs of a great many more which I hope will shew up in a few days time.—H L W Stock, Assistant District Officer.—*B. N. B. Herald*, Nov. 16.

TEA AND RUBBER IN NYASALAND.

The report by Governor Sharpe on the Nyasaland Protectorate for 1908-9 states that the tea crop is chiefly confined to the Mlanjo district, 598 acres being under cultivation. There is an experimental plot of three acres in the West Shire district. A considerable quantity is consumed locally, and during the year 23,948 lb. were exported. Tea will always be a minor item in the products of Nyasaland owing to the restricted areas suitable for its cultivation. With the exception of South East Mlanje, West Nyasa is the most ideal district from a climatic point of view. Rubber cultivation promises to become an important feature in Nyasaland, and there should be a considerable export of cultivated rubber within the next two or three years. During 1908-9 over 1,000 acres were planted, and 3,523 acres are now under cultivation. The climate, on the whole, is too dry for Para and Castilloa, but Ceara grows extremely well on suitable soils. A number of seeds of the new Manihots—M. Dichotoma and M. piauhuyensis—have been imported, the percentage germinating proving very low. The growth of both species is, however, promising and it is hoped that the reported astonishing yields of rubber obtained in their natural habitat will be maintained under cultivation. Para (Hevea Brasiliensis) is grown in the West Nyasa district where the rainfall is copious and well distributed throughout the year. Plants which have been established about three years are full of promise, being over 20 feet high. Castilloa elastica is also making excellent growth in this particular district. Experimental plots of Funtumia elastica are established in various parts of the Protectorate, but the rate of growth is so far disappointing. During the year 1908-9 15,415 lb. of rubber was exported, valued at £3,083, of which 1,514 lb. was cultivated rubber, 13,901 lb. being collected from indigenous vines. —*H. & C. Mail*, Nov. 19.

BRAZILLIAN RUBBER.

Some Interesting Information Regarding Amazon Production.

[The writer of the following article decided to personally investigate the position and possible prospects of Brazilian rubber (i.e., "wild") on the spot in 1902-3. It was not, however, until 1906 he was able to put his intention into effect, but in the last-mentioned year he was able to proceed to South America, and in the following article, which we print without assuming responsibility for his views and comments, he gives the result (in petto) of his investigations.—Ed. F. & B.]

Arriving in Para, I found that it would be useless to try and depend on any second-hand particulars I might receive, and, going on to Manaos, had little better success. Few, if any, of the rubber growers keep a set of books that any accountant could make head or tail of, although their gross turnover might be £50,000 a year. The brokors, merchants, and importers and shippers did not appear to be the men who would assist a Company representative in any serious investigations, seeing that they are concerned in upholding the present system, which is by far the best way of doing business they are aware of. Beyond that, the knowledge they possess of a working rubber estate would not be of great value, being only concerned with the produce after the arrival at either Para or Manaos.

How Rubber is Handled.

The system of working or gathering rubber and handling seemed to be the most difficult to understand, and everyone interested had different views on the matter. Having travelled up to and through some big working properties on the Upper Amazon, I had little further trouble in getting at the exact position of both rubber grower or owner or labourer. Taking first an estate producing 150 tons per annum and employing 450 men, the owner would have his own river steamer of about 70 or 80 tons burden carrying his own goods up river, returning with rubber in the season from July to January very little fine rubber being collected during the earlier months (caucho only is gathered in wet season on uplands). The grower usually makes all arrangements for a year's supply of merchandise in the months of April to June; if his credit is very good, his advances will cost him 1 per cent a month; if only average, from 1½ per cent to 2½ per cent per month; and the cost of his goods, after being landed in merchant's warehouse duty paid, etc., and the other costs will be 18 per cent to 25 per cent wholesale and about 45 per cent retail higher. Therefore, the supplies for 450 men would be about £30,000, under most favourable terms, on arrival of goods at seringal (or estate) on any of the lower part of Purus, Jurua, or Jutaby rivers. The headmen (or chiefs), I may mention, receive the stuff from the owner, paying him (in rubber, when it is gathered), in addition to insurance (2 per cent to 3 per cent) and costs of handling, freight charges, etc., a commission of 10 per cent. The headman or chief may have from six to thirty men under him, and will mark the goods received from the grower at an advance of 25 per cent to 50 per cent. The labourers are supposed to be responsible to the chiefs, and they in turn to ownors, for goods advanced. Each ordinary labourer works to estradas or zig-zag roads which wind around through the jungle until they connect up 100 to 150 trees each road, and the number of trees will, without any damage or injury give from 300 to 400 kilogrammes in a season or up to 880 lb. The labourer lands this on the river banks, and pays 10 per cent through the chief or the owner as royalty. The price he receives for rubber is from 1,500 to 2,000 reis per kilogramme below market price. The rubber is not weighed or cased in Manaos, and any impurities caused by the labourer are charged up to him. The cost of both is paid by the grower, if he prefers to cut or classify his own rubber, as most of them do.

The price on which duty is paid, called pauta [?] is arranged every Sunday, and is based on the kind—Manaos or Para, as the case may be—value ruling during the previous week, and whether rubber goes up or down, it remains the same. This price with rubber is at 5s per lb. for fine hard Para in London would work out at 3s 6d per lb. in Manaos. The costs that have to come out of the 1s 6d difference would be cartage to harbour dues, export dues (22¼ per cent.), dispatch and stamp, insurance, fire and marine dues, and freight to Liverpool (about £3 5s per ton).

Of course, rubber shipped direct after being brought down river would, on arrival in Europe, have reduced in weight from 3 to 4 per cent., but it all depends on where it has come from. To arrive at the actual cost of producing rubber and landing it in Europe it is necessary to consider the actual price then ruling, as everything is on a sliding scale and varies weekly if the market price does. I propose to take the price at 5s per lb. (London) and exchange at 15⅛d. Under these conditions the cost to place of consignment in cases on Manaos market would be 2s 3d to 2s 6d per lb. To this one may add the export dues and freight to Liverpool, which will fetch the cost up to about 3s 4d per lb. landing in this country. This gives the profits that would be made by an ordinary property working under the general custom and subject to all charges, being of course, able to send produce to Europe. This some of the growers can do, but I am showing this as an example. The only growers who also are exporters are men who, being merchants, have acquired properties through making advances on merchandise and take less interest in the working of their estates than the original owners.—*Financier*, Nov. 15.

RUBBER IN COCHIN-CHINA.

Papers laid before the Colonial Council at Saigon show that rubber cultivation has gained a firm foothold in Cochin-China. The area under Hevea had risen from 30 hectares (7½ acres) in 1906 to 564 hectares in December, 1908. The estates are mostly in the hands of the companies which command plenty of capital. Only one of them, the Xatrach Co., deals exclusively in rubber; the others grow different catch-crops. —*Straits paper.*

A NEW RUBBER SUBSTITUTE.

RUSSIAN CHEMIST'S REMARKABLE IMITATION.

It has been left to a Russian chemist of the name of Plinatus, to make what certainly is a "real" imitation rubber. After three years of persistent experimenting and inventing, and what is perhaps more important, the discovery of entirely new chemical re-actions, an imitation rubber has been produced which to the eye is as real as the purest rubber. This

PLINATUS RUBBER HAS BEEN PATENTED IN GERMANY,

and patents have been applied for in all foreign countries. In Paris one of its many uses has been the introduction of Plinatus, rubber for both pneumatic and solid rubber tyres. This may seem contradictory, but the explanation is simple: for outer tyres Plinatus cannot be used, but for the filling of the inner tubes, it replaces air in the pneumatic tyres, and it replaces real rubber in the solid tyres. Cab proprietors in Paris have experimented with it for 18 months, and so satisfactory are the results that the German Company which bought the German rights and started a factory on the 1st instant, have contracted with the patentees to establish a branch factory in Paris on or before the 1st December next, and in the meantime the German Company are filling the wheels for Paris cabs. Speaking of the substance itself, we might point out that Plinatus rubber is

TOUGH, FIRM, EXCEPTIONALLY PLIABLE, HIGHLY ELASTIC AND OF THE SAME CONSISTENCY AS REAL RUBBER.

To the touch it is identical with rubber, and in appearance difficult to distinguish; it can be made soft, hard or leatherlike according to requirements. The specific weight varies from 0·6 to 1·18 the tensile strength by the soft rubber is 20 to 25 per cent. less than that of real rubber. It withstands pressure to almost a higher degree than rubber itself. The artificially introduced air bubbles give it an exceptionally strong expanding power. Prepared as soft rubber it withstands a pressure of about 10 lb. per qcm. The hand rubber up to 40 lb. per qcm. Light has no influence upon it; further it is absolutely insoluble in benzine, ether, turpentine, petroleum, tetrachlor acid, etc., and entirely indifferent to all mineral and vegetable oils. It is the only rubber real or imitation that will withstand these oils, and at the same time not swell. The prime cost of production is from 3d. to 8d. per lb, depending upon the uses for which it is intended. Coming back to one of its main uses, cab and other vehicle tyres, Plinatus rubber promises to cause a revolution in the trade. The inner tubes are filled with Plinatus rubber and produces a tyre of exceptional strength and durability. The drivers of Plinatus rubber tyres do not know the meaning of puncture or bursted tyres and drive with the same perfect ease and comfort as the best pneumatic tyre. Compared with solid tyres it has the enormous advantage in cost and further in durability and in elasticity, etc., hitherto only connected with pneumatic tyres. At the present time

ARRANGEMENTS ARE IN PROGRESS TO SUPPLY 1,000 CABS IN PARIS

with tyres filled with Plinatus rubber. So many imitation rubbers have been placed before the trade, that it is small wonder that people get sceptical, but we understand that the patentee is willing to receive through his representatives in Berlin or London four wheels of a cab or brougham, which he at his own expense will fill with Plinatus rubber and return, that the owner thereof may convince himself as to the merits of "Plinatus" rubber. "Plinatus" rubber, it should be stated, does not get hard or brittle, and time does not rob it of its elasticity. It is long past the experimental stage, and arrangements are pending for the sale of the British rights. Another feature of no little importance is the fact that a very small sum suffices for the starting of a factory on a small and yet absolutely paying scale. The British patent rights are in the hands of Mr. Friedrich Lehfeldt, of Berlin, S. W. 68, or his London agent, Mr. A M Lehfeldt, 50, Buckingham Palace Road, S. W. Either of these gentlemen will be pleased to give interested parties the requisite information or to take them over the factory at Krefeld.—*Financial World*, Nov 13.

PROPORTION OF SCRAP TO FINE RUBBER.

Our correspondent "C W H" elsewhere raises an interesting question when he asks what proportion planters regard as a fair average for the amount of Scrap, collected in course of tapping any particular area, to bear to the whole crop collected at any one time. He mentions cases of 5 and 40 per cent. and also of planters who say they never have any Scrap. The average doubtless lies between the two first, while the last group must be simply converting thoir Scrap into something else. We would like to hear the opinions of leading rubber planters on this interesting point.

November 29th.

DEAR SIR,—During the operation of tapping rubber trees more or less latex is spilled over the adjacent bark; and when the "spillings" are sufficiently set, they are collected and brought to the factory as "scrap." Scrap being more or less mixed with impurities, its value is naturally less than the product of pure latex; but where appliances are at hand, it is possible to clean and convert scrap into dark-coloured crepe, which is well appreciated by the trade and commands a very fair price; and in such cases none of the produce is sent to market as scrap. When this is the case, if the question is asked, "What proportion does your scrap bear to your No. 1.," the answer sometimes is: "Oh! we have no scrap"; but I think that answer rather evades the question. I believe it is pretty well established that weather conditions greatly influence the amount of spill in the process of tapping; but what I should like to find out is—what is the consensus of planting opinion as to the proportion which scrap should bear to the whole crop on a well-managed place with fairly expert tappers, *i.e.*,

PROPORTION OF SCRAP TO FINE RUBBER.

[The following letter should have appeared at the beginning of page 573] :—

November 30th.

Sir,—The subject your correspondent has brought up is an interesting one, but a great deal depends on the method of tapping and the method employed in collecting the scrap. I don't go in for pricking, and I believe the use of the pricker induces a greater percentage of scrap. With the use of a drip tin and plenty of water in the channel, the quantity of scrap is very little; and this avoids labour spent in collecting scrap and keeps the channels quite clear. There is also the question of time of tapping, and the effect of sun on the trees. The earlier the tapping is completed, the better. But I know of tapping with the use of the drip tin which resulted in almost no scrap in the channel. There is, of course, the difficulty of latex running out of the channel and over the trunk, specially in wet weather and when the flow of milk is very free. This generally forms a very thin layer of rubber on the trunk which escapes attention and is difficult to remove. This is really wasted, and the action of the sun and air soon causes oxidation and the rubber turns black, causing the whole trunk to have that blackened, burnt appearance so common in the Kelani Valley, &c.

The scrap in the channels if collected early, before oxidation sets in, and at once run through the washing machine will turn out excellent crepe. But the bark shavings, if collected and then passed through the washer, will give a small, but paying, quantity of fair rubber, which as "creped scrap" is really scrap.

"Scrap rubber" in the trade at home is old and refuse tyres, rubber shoes, hose, rubber mats, &c., &c., which is purchased by the "reclaimed rubber" workers, and after the rubber is got back and reworked it is offered for sale as "recovered" or "reclaimed" rubber. It is a paying business at present high prices of raw rubber.

If your correspondent looks well after his tapping, and insists on good work by the coolies, and uses drip tins, he will get hardly any scrap.

H. V. A.

the average proportion for the year, *if all the scrap is duly collected*? I have figures before me, giving in one case 5 per cent and in another 40 per cent; but I feel sure that these are both extreme. Can any of your correspondents indicate what should be looked on as a fair standard of proportion.

Colombo, Dec. 3rd.

DEAR SIR,—I am very much obliged to your correspondent "H. V. A." for the interesting particulars in his letter.

I note well the pregnance of his closing para but the question is still that which I propounded in my first letter, viz: What does "hardly any scrap" in his case amount to—as a percentage on the whole crop?—Yours faithfully, C. W. H.

THE TEA INDUSTRY AND LABOUR-SAVING MACHINERY.

Now that crops have proved a full success and there is a promise of fat years to come, food must become cheaper. The recruiting of coolies will become more difficult. Fewer coolies will be recruited and these not of the best. It behoves the Tea Industry, therefore, to look round and see in which way labour can be saved, by the use of machinery. Railways are slowly opening out the best coolie recruiting districts, Chota Nagpur and the Central Provinces. The aboriginal coolie is finding employment in other directions than tea. Coal and other mines, though not liked as much as the tea garden, are taking away numbers of coolies, being closer to their homes and offering better pay. If measures are not adopted to employ machinery in field work, there is disaster awaiting a number of gardens which are bound to go out of cultivation. The poor China gardens will suffer first and then the poor Hybrid and poor soil gardens. Although machinery is used in all processes of manufacture, and every year sees new improved machinery for use in the factory, planters still rely on the hoe for cultivation and fingers for plucking. No effort has been made to bring the field works into line with the modern factory. We still go on in the garden in the style of Noah. Engineering genius has made marvellous strides in the factory, but has given the field work no thought, though there is an enormous and profitable field to work on, in the tea field. Let us turn to agricultural machinery and see in what way tea can use the machinery now existent. If you were to ask a planter why ploughing was not suitable for tea, he would tell you it tears up the roots and smashes the bushes, but if you point out that coolie hoeing cuts up the roots also, he says no; but the coolie if watched does cut up roots, quickly buries them and leaves no trace. With ploughing it is different; the plough does tear up feeder-roots and the man in charge has no means of covering them up. As regards knocking about bushes it is due to badly trained cattle. A well-trained pair of bullocks can cultivate Indian corn or jute planted one foot apart; why not tea planted 3 to 6 feet apart? Leaving the question of ploughing with bullocks and turning to machinery, there is no reason why steam traction, oil or motor engines with the drum and coil of rope should not be used in

PLOUGHING TEA,

as they are used in other countries. Of course the ploughs would have to be adapted to the work, probably a middle breaker with right and left hand ploughs on each side could easily plough a row of teas, doing three to four feet furrows. Then again the middle breaker with a subsoil plough could do trench hoeing, and even drawing could be done by drawing ploughs. This would cover the heavy hoeing work performed now by men, who year by year as the call for labour is getting louder are getting scarcer and are going off to lighter jobs when the season for deep hoeing comes. Again for light hoeing there are the cultivators' tools that can both fill up and take away the earth from a plant as wanted. Of course, those would have shields adjusted to them to protect the bushes. This could easily be done. Ploughs of this sort could not be drawn by bullock traction and would, of course, have to be worked by powerful engines of at least 30 break horse power, while even 50 to 60 b h p would not come amiss at times. Instead of manuring by hand a manure spreader could be employed, or a drill could be used behind the cultivator or ploughs for the more concentrated manures. It has been the want of these powerful engines that has made the ploughing of tea seem impossible. The "no innovation," old style planter will, of course, say these ploughs could not be worked in old tea, as they would rip up any bushes that were not planted in the straight. This may be so, but it would be better to knock out the few bushes not in the straight than to allow the whole lot to suffer for the want of cultivation. Of course, using these ploughs does not mean that we would be able to get rid of all manual labour; ferns and jungle in the bushes would have to be taken out by hand. This can be done even by children in most cases and would only need men where a garden had beed shamefully neglected. Turning to pruning, this is a more difficult operation; but there is

NO REASON WHY TOP LIGHT PRUNING SHOULD NOT BE DONE BY SOME REAPING OR HOEING MACHINE,

Collar pruning, of course, could be worked by horizontal saws with a light motor engine. This, no doubt, would be neater and cheaper than the present tackling of tho work with big pruning knives, dows, kookries etc. Plucking could also be performed by some such contrivance as a reaping or mowing machine. Such a machine, of course, would rip everything off the bush, and arrangements would have to be made in the factory to separate the coarse from the fine or the garden would go in for a coarse grade of cheap tea. In many cases it would be more profitable to rip everything off the bush, than to allow, as is now very often the case, the bush to overgrow itself in the height of the season when there is more growth than the labour force can tackle, and then quickly shut up at the end of the season.

Cutting jungle in the tea might also be effected by any of the reaping machines and in many gardens a catch crop of hay could be gathered were these binders and pressers to do the work.

Beside these routine works there are others such as spraying for blight. This could be done systematically and in sufficient quantity daily to eradicate mosquitoes, red spiders and various other blights. Again, stump pulling, and the pulling up of old tea, could all be carried out by traction machinery, at a considerable saving and more efficaciously than at present by hand. In several gardens where the cattle die off year by year traction engines could easily take out the tea to railway stations and bring in the stores. There are many occasional jobs on an estate that could be done by these machines and it would ease the labour question very considerably if machinery were introduced into the field work.

ANTI-SKEETER.

—*Statesman*, Dec. 1.

IMPORTATION OF INDIAN TEA SEED AND BLISTER BLIGHT.

Kandy, Nov. 22nd.

SIR,—I shall be much obliged if you will kindly publish correspondence forwarded herewith for the information of importers of Indian Tea-seed.—Yours, &c.,

ALEX. WARDROP,
Secretary, P.A. of Ceylon.

(*Correspondence referred to.*)

Colonial Secretary's Office, Colombo,
13th October, 1909.

Sir,—I am directed to transmit for your information the enclosed copy of a letter received from the Acting Director of the Royal Botanic Gardens together with a copy of its enclosure calling attention to the danger of the introduction into Ceylon of the leaf disease in tea known as "Blister Blight" by the importation of tea seed from India, and to state that it is proposed to issue a notification under "The Insect Pest and Quarantine Ordinance 1901" as advised by the Director.—I am, Sir, your obedient servant, (Sgd.) E. B. DENHAM, for Colonial Secretary.

The Chairman, Planters' Association of Ceylon, Kandy.

Royal Botanic Gardens, Peradeniya,
21st September, 1909.

SIR,—I have the honour to forward to you a copy of a letter addressed to me by the Government Mycologist and to request that steps may be taken to prohibit the importation of tea seed from India unless accompanied by a statement from a responsible Scientific Officer to the effect that the seed in question does not come from a district infected with the "Blister Blight" ("Exobasidium vexans.")—I am, Sir, &c. (Sgd.) R H LOCK, Acting Director, R. B. G.

The Hon. The Colonial Secretary.

From Government Mycologist To Acting Director, Royal Botanic Gardens.

September 21st, 1909.

SIR,—I have the honour to direct your attention to the necessity for some regulation of the present importation of tea seed.

2 Large acreages will shortly be opened up in Tea in Ceylon, and quantities of seed are being or will be imported from India.

3 Tea in North India is at present suffering severely from a leaf disease known as 'Blister Blight,' caused by a fungus, '*Exobasidium vexans.*'

4 This disease does not occur in Ceylon, and there is grave danger of importing it with the seed. I would suggest that Government be asked to forbid the importation of tea seed from India, unless accompanied by a certificate that it does not come from a district infected by Blister Blight. A certificate from a scientific officer of the Indian Tea Association might be accepted.—I am, Sir, &c, (Sgd.) T PETCH.

The Hon. The Colonial Secretary, Colombo.

Kandy, 15th October, 1909.

SIR,—Referring to your letter of 13th instant, with enclosures, on above subject, I am directed to state, that whilst my Association fully approve of measures being taken to prevent the importation of "Blister Blight" into Ceylon, they would wish to be informed if this object cannot be equally attained by the compulsory disinfection of Indian Tea seed (unaccompaued by a certificate) at Colombo, as by prohibiting its importation?—I am, Sir, your obedient servant, (Sgd.) ALEX. WARDROP, Secretary, Planters' Association of Ceylon.

The Hon. The Colonial Secrotary, Colombo.

Kandy, 16th November, 1909.

SIR,—Referring to my letter of 15th October on above subject, I have the honour to enquire if the suggestion made in it as to the disinfection of Indian Tea Seed at Colombo has been approved by the Government advisers; and if so, what steps are proposed to be taken to give effect to the recommendation?—I am, Sir, your obedient servant, (Sgd.) ALEX. WARDROP, Secretary, Planters' Association of Ceylon.

Colonial Secretary's Office, Colombo.

November 19th 1909.

SIR,—With reference to your letter of the 15th October, 1909, relative to proposed measures for preventing the importation of "Blister Blight" into Ceylon, I am directed to forward to you the enclosed copy of a report thereon by the Director, Royal Botanic Gardens, and to inform you that the proposals contained therein have been approved by the Governor in Executive Council and that regulations will shortly be issued accordingly.—I am, Sir, your obedient servant, (Sgd.) E. B. DENHAM. for Colonial Secretary. The Secretary, Planters' Association of Ceylon, Kandy.

Royal Botanic Gardens, Peradeniya,
19th October, 1909.

The Hon. the Colonial Secretary,

Sir,—The Government Mycologist reports as follows :—

"Tea seed could be disinfected in Colombo by immersion in a 1 per cent Corrosive Sublimate. This will not be possible if the seed has germinated before arrival, and it is only practicable if

the seed is consigned in bags. If the seed is consigned in chests, it would have to be unpacked for treatment; and this would entail a large amount of labour, and additional apparatus for handling the seed. It is, of course, understood that the operation would be carried ont at owner's risk. I would suggest that the importation of Indian Tea seed be allowed:

(*a*) if accompanied by a certificate.

(*b*) if imported in bags, so as to readily admit of treatment."

If the recommendations are approved, steps ought to be taken immediately; otherwise the precautions may come too late to prevent the importation of the disease.—(Sgd.) R H LOCK., Acting Director, R B G.

JUGRA ISLAND: A YEAR'S PROGRESS.

Jugra Island came into prominence some three years ago when a company with the title of Jugra Land and Rubber Estates, Ltd., was successfully floated at Home. Work was speedily commenced under the management of Mr F A Callaway, and since then remarkably rapid progress has been made in bringing under cultivation what pessimists in their ignorance of local conditions described as the impossible.

About a year ago we showed how this island, formerly given over to a tribe of Sea Sakeis and rotan-cutters, had been opened up to a very considerable extent in the interests of the company mentioned above, explaining how, through the adoption of an intelligent system of drainage, land that had been regarded as swamp had been made to carry rubber, and how it was proposed to deal with and extend the property in the future. The results may be best summarised by giving the figures, though it is only fair to add that the soil and climate alike have proved themselves so favourable to the growth of vegetation that development has been considerably retarded by the necessity for keeping down undesirable growth in the shape of weeds. But this is now so well in hand that no serious trouble in the future should be anticipated.

On Oct. 31st, 1908, the position was as follows: Land drained, 3,630 acres; felled, 2,737½ acres; burnt off, 300 acres; cleared, 185 acres; planted with Para rubber, 1,721. acres; planted with coconuts, 70 acres; coconuts and bananas, 2 acres; fruit trees, 10 acres.

On Oct. 31st of this year the situation was:—Drained, 4,150 acres; felled, 4,030 acres; burnt off, 525 acres; cleared up, 365 acres; planted with Para, 2,233 acres; with coconuts, 332 acres; coconuts and bananas, 15 acres; fruit trees, 10 acres; bananas, 10 acres.

The position is that the company is

PLEDGED TO PLANT OUT 4,150 ACRES IN FIVE YEAR

from the pate of the grant, May, 1906, and in spite of adverse conditions in the shape of exceptional rainfall and the consequent rapid growth of weeds, there does not appear to be any doubt that the required acreage will be achieved within the time-limit.

Apart from the figures given above showing the acreage development, the improvement in the company's property during the past year has been considerable. To begin with, a broad main road, three miles in length and perfectly straight, has been constructed through the heart of the property; the drains have been deepened and flood-gates erected; four bungalows have been built for the manager and his assistants, besides two new sets of coolie-lines, with another in course of construction, and the hospital has been completed. The result is that, at the present moment, there is one vast clearing from the landing-place from Port Swettenham right across the island to the shore opposite Jugra, measuring some three miles in the other direction; and nearly the whole of this large area has been already planted up.

There is at present a force of nearly 2,000 coolies on the island, mostly Tamils, with the remainder Javanese and Banjerese, and it is striking testimony to the healthiness of the locality that last month there were no cases of serious sickness, apart from two deaths, one due to old age, and the othor to shall-fish poisoning. Even in the hottest portion of the day there is a refreshing breeze, and the coolies, speaking generally, are as healthy a looking lot as one would find anywhere in the peninsula. And, moreover—a significant fact—they have all the appearance of being well satisfied with their position.

Of old, of course, the island was not devoid of its romantic side, and a trace of this may be found today in the herd of elephants—if elephants can by any stretch of the imagination be made to weave their way into romance—which still inhabits it. As the island has been cut in two by the vast clearing mentioned above, this herd has been confined to the southern portion, though not without a struggle. Signs of this may still be seen upon the southernmost drain of the cleared portion, where comparatively recently they attempted a crossing. Foiled at first, owing to the fact that the drain in question was deep and of sufficient width to prevent their stepping across, they endeavoured to send the youngsters over, but without appreciable success. They then attempted to build a bridge across by placing timber over the drain, but either their patience gave out or they were interrupted. At all events they were foiled, and since then they have not attempted to recapture their former territory. The result is interesting, for it proves that a drain constructed of exactly the right size—a barrier that would offer no obstacle to the meaner animals of creation—is sufficient to hold in check these mammoths of the jungle. It is a simple solution of the problem, and one, moreover, that cannot but excite wonder when it is seen what havoc they have wrought in the jungle on their own side of the drain in question, for it is

SO THINNED OUT AS ALMOST TO RESEMBLE A CLEARING.

Steps have been takon to link the island up with the mainland by the introduction of the telephone, and after a *rentis* had been cut through to the north opposite Pendamaran, the line was laid, and a fortnight ago the bungalows on various parts of the large cleared area were linked up, the local exchange being in the manager's house. Satisfactory communication was established at the first attempt. At

this period the cable under the river from Pendamaran had been laid, so that the somewhat peculiar position of the island having its own internal

TELEPHONIC COMMUNICATION,

though debarred from that with the world outside, was established by means of a storage battery at the estate headquarters. This was a great boon, but the position was improved considerably yesterday when through communication was established with Kuala Lumpur,

The installation of this telephone system has been no light task, as any one who has been over the track could testify, and the achievement is one upon which the authorities concerned may well be congratulated.

The Jugra Land and Rubber Estates, Limited, has parted with 5,000 acres of its property on the island to the recently floated

CAREY UNITED RUBBER ESTATES,

which absorbs Paradise Estate, near Kajang. With the sale of this large acreage and the old quit rent of only 50 cents per acre, the original Company should have no difficulty in reaching the tapping stage with comfort.

MR. E. V. CAREY

the Managing Director of the Company, is expected here at the end of this month, and he will then relieve Mr Callaway of tho management for the time being. The latter is proceeding home for a long holiday after a lengthy period of more arduous work than usually falls to the lot of the planter, oven in the tropics.—*Malay Mail*, Nov. 18.

COCONUT MILK.

(*To the Editor, "Madras Mail."*)

SIR—In one of the recent issue of the *Madras Mail* "C.K." speaks of tapioca as a choap digestible food and mentions a vareity which is poisonous. The poison is due to the presence of prussic acid. To get rid of prussic acid, all that is necessary is to peel and boil the tuber properly. Another precaution which the people on this coast take is to eat the boiled tuber with coconut. Coconut, it is well known here, takes away the deleterious effect of prussic acid. Whether coconut milk is an antidote to poison or not, it is any rate certain that it neutralises the harmful effect of opium and nicotine. Some three years ago a man who had taken a *majami* pill (a mixture of opium and ganja) was found to be rolling on the floor of his house and appeared to suffering much from the effect of the drug. Coconut milk was given to him with the result that he recovered within two hours. If cocoatine can be a substitute for butter, I see no reason why coconut milk cannot be a substitute for cow's milk. As cow's milk is considered by medical authorities to be a means of conveyance of enteric fever, the substitute will go far in preventing such fever. Coconut milk can be used in flavouring coffee. And when enteric prevails it would be advisable to use coconut milk instead of cow's milk, especially in barracks.

Calicut. F.R.

—*M. Mail*, Dec. 6th.

THE BLACK HEVEA FUNGUS IN THE F. M. S.

Another sample of the black fungus described in the July number of the Bulletin, page 310, has been received at the Botanic Gardens, Singapore, from Selangor. In this case the fungus had attacked stumps about 3 inches in girth. No less than 80 per cent of the stumps were found to be killed by this pest. In this case the fructification of the fungus had appeared in abundance at a height of 2 feet and all down the tap root. This shows that the fungus does not confine itself to the upper branches of trees, but, apparently, it can attack almost any young part of the plant. Dangerous and troublesome as this pest is likely to prove to young plants in nurseries, it would be more so if it attacked adult trees or trees in bearing, not only on account of the greater loss, but also because it would be much more difficult to deal with.

In any case this seems likely to prove as dangerous a plant as the *Fomes*, if not worse and its history and the best means of combating, it should at once be carefully investigated.—ED.
—*Straits Agricultural Bulletin*, for November.

SOYA (OR SOY) BEAN.

The Soya beans about which we have been receiving enquiries, is an annual plant, growing to a height of 15 to 18 inches, of an erect habit, with large hairy trifoliate leaves and stout hairy 3 to 5 seeded pods. There are black and white-seeded varieties, the latter apparently being the more generally cultivated. In general appearance the plant is not unlike the common dwarf Kidney or French bean. The Soyo Bean thrives at Peradeniya and appears to be well suited to the climate and soil. Here the seeds germinate in 3 to 5 days, the plants flower when a month old: a fortnight later the pods are fit for picking, and the harvesting is complete in abouc two months from the time of sowing. A full account of the Soya Bean by Mr. H. F. Macmillan had appeared in the "Tropical Agriculturist and Magazine of the Ceylon Agriculture" four years ago. In the London *Times* of November 13th we read the following:—

The annual report of the Hull Chamber of Commerce and Shipping just issued states that the Seed Crushers' Committee report that "the mills have been fairly well employed, and for the first time in the history of the trade soya beans have been crushed in quantity." The Hull Seed, Oil, and Cake Association report that "the outstanding feature of the year has been the advent of the soya bean from Manchuria, which marks an epoch in the crushing trade of the United Kingdom. About 400,000 tons have been shipped to the United Kingdom in 1909, of which 153,000 tons have arrived in Hull since March last. Without this large addition to the available raw material for the mills, crushing must have been a lean business during the 12 months, whereas this addition, combined with rising markets helping manufacturers, who anticipated their requirements, has on the whole proved to be fairly remunerative in 1909. There is reason to hope that the soya bean will be a regular article of import."